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DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01312

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SECTION 01312

QUALITY CONTROL SYSTEM (QCS)

PART 1 GENERAL

1.1 GENERAL

The Government will use the Resident Management System for Windows (RMS-W) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS-Windows, referred to as QCS (QC for Quality Control), to record, maintain, and submit various information throughout the contract period. This joint Government-Contractor use of RMS-W and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

- Administration
- Finances
- Quality Control
- Submittal Monitoring
- Scheduling
- Import/Export of Data

1.1.1 Correspondence and Electronic Communications

For ease and speed of communications, both Government and Contractor will, to the maximum extent feasible, exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record shall also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

1.1.2 Other Factors

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Section 01320, "Project Schedule", Section 01330, SUBMITTAL PROCEDURES, and Section 01451, CONTRACTOR QUALITY CONTROL, which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith shall be included in the contract pricing for the work.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. ARMY CORPS OF ENGINEER (USACE)

EM 385-1-1

(2003) Safety and Health Requirement Manual

1.3 HARDWARE/SOFTWARE REQUIREMENTS

1.3.1 Installing the QCS Program

The QCSSetup<version>.exe is the program that you will begin the installation with. Launch the program through your Windows Explorer, the Run command, or however you are used to doing that sort of thing. This is self-extracting file and will create the necessary files and folders and complete the installation and set up your program. The window will close automatically when the extraction process is completed.

The program should install itself, asking only minimal questions. The program will tailor the installation to suit the computer it is being installed on. That is, the program will install a "new" program if one has not already been installed, it will install an "update" if the program is already installed on the computer and will determine each client or server requirement and automatically install/update what is required. Each screen and instruction is shown on the following pages.

1.4 QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Government will make available the QCS software to the Contractor after award of the construction contract. Prior to the Pre-Construction Conference, the Contractor shall be responsible to download, install and use the latest version of the QCS software from the Government's RMS Internet Website. Upon specific justification and request by the Contractor, the Government can provide QCS on high-density diskettes or CD-ROM. Any program updates of QCS will be made available to the Contractor via the Government RMS Website as they become available.

1.5 SYSTEM REQUIREMENTS

The following listed hardware and software is the minimum system configuration that the Contractor shall have to run QCS:

Hardware

IBM-compatible PC with 500 MHz Pentium or higher processor

128+ MB RAM for workstation / 256+ MB RAM for server.

1 GB hard drive disk space for sole use by the QCS system.

3-1/2 inch high-density floppy drive.

Compact Disk (CD) Reader 8x speed or higher.

SVGA or higher resolution monitor (1024x768, 256 colors).

Mouse or other pointing device.

Windows compatible printer. (Laser printer must have 4 MB+ of RAM).

Connection to the Internet, minimum 56k BPS

Software

MS Windows 98, ME, NT, or 2000.

Word Processing software compatible with MS Word 97 or newer.

Latest version of: Netscape Navigator, Microsoft Internet Explorer, or other browser that supports HTML 4.0 or higher.

Electronic mail (E-mail) MAPI compatible.

Virus protection software that is regularly upgraded with all issued manufacturer's updates.

1.6 RELATED INFORMATION

1.6.1 QCS User Guide

After contract award, the Contractor shall download instructions for the installation and use of QCS from the Government RMS Internet Website; the Contractor can obtain the current address from the Government. In case of justifiable difficulties, the Government will provide the Contractor with a CD-ROM containing these instructions.

1.6.2 Contractor Quality Control(CQC) Training

The use of QCS will be discussed with the Contractor's QC System Manager during the mandatory CQC Training class.

1.7 CONTRACT DATABASE

Prior to the pre-construction conference, the Government will provide the Contractor with basic contract award data to use for QCS. The Government will provide data updates to the Contractor as needed, generally by files attached to E-mail. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

1.8 DATABASE MAINTENANCE

The Contractor shall establish, maintain, and update data for the contract in the QCS database at the Contractor's site office. Data updates to the Government shall be submitted by E-mail with file attachments, e.g., daily reports, schedule updates, payment requests. If permitted by the Contracting Officer, a data diskette or CD-ROM may be used instead of E-mail (see Paragraph DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM). The QCS database typically shall include current data on the following items:

1.8.1 Administration

1.8.1.1 Contractor Information

The database shall contain the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver Contractor administrative data in electronic format via E-mail.

1.8.1.2 Subcontractor Information

The database shall contain the name, trade, address, phone numbers, and

other required information for all subcontractors. A subcontractor must be listed separately for each trade to be performed. Each subcontractor/trade shall be assigned a unique Responsibility Code, provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver subcontractor administrative data in electronic format via E-mail.

1.8.1.3 Correspondence

All Contractor correspondence to the Government shall be identified with a serial number. Correspondence initiated by the Contractor's site office shall be prefixed with "S". Letters initiated by the Contractor's home (main) office shall be prefixed with "H". Letters shall be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C".

1.8.1.4 Equipment

The Contractor's QCS database shall contain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

1.8.1.5 EM 385-1-1, Corps of Engineers Safety Manual and RMS Linkage

Upon request, the Contractor can obtain a copy of the current version of the Safety Manual, EM 385-1-1, on CD. Data on the CD will be accessible through QCS, or in stand-alone mode.

1.8.2 Finances

1.8.2.1 Pay Activity Data

The QCS database shall include a list of pay activities that the Contractor shall develop in conjunction with the construction schedule. The sum of all pay activities shall be equal to the total contract amount, including modifications. Pay activities shall be grouped by the Contract Line Item Number (CLIN), and the sum of the activities shall equal the amount of each CLIN. The total of all CLINs equals the Contract amount.

1.8.2.2 Payment Requests

All progress payment requests shall be prepared using QCS. The Contractor shall complete the payment request worksheet and include it with the payment request. The work completed under the contract, measured as percent or as specific quantities, shall be updated at least monthly. After the update, the Contractor shall generate a payment request report using QCS. The Contractor shall submit the payment requests with supporting data by E-mail with file attachment(s). If permitted by the Contracting Officer, a data diskette may be used instead of E-mail. A signed paper copy of the approved payment request is also required, which shall govern in the event of discrepancy with the electronic version.

1.8.3 Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. The Contractor

shall provide the Government a Contractor Quality Control (CQC) Plan within the time required in Section 01451, CONTRACTOR QUALITY CONTROL. Within seven calendar days of Government acceptance, the Contractor shall submit a data diskette or CD-ROM reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

1.8.3.1 Daily Contractor Quality Control (CQC) Reports.

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS shall be the Contractor's official report. Data from any supplemental reports by the Contractor shall be summarized and consolidated onto the QCS-generated Daily CQC Report. Daily CQC Reports shall be submitted as required by Section 01451, CONTRACTOR QUALITY CONTROL. Reports shall be submitted electronically to the Government using E-mail or diskette within 24 hours after the date covered by the report. Use of either mode of submittal shall be coordinated with the government representative. The Contractor shall also provide the Government a signed, printed copy of the daily CQC report.

1.8.3.2 Deficiency Tracking.

The Contractor shall use QCS to track deficiencies. Deficiencies identified by the Contractor will be numerically tracked using QC punch list items. The contractor shall maintain a current log of its QC punch list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list. The Government's QA punch list items will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of both QC and QA punch list items.

1.8.3.3 Three-Phase Control Meetings

The Contractor shall maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

1.8.3.4 Accident/Safety Tracking.

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of the safety comments. In addition, the Contractor shall utilize QCS to advise the Government of any accidents occurring on the jobsite. This brief supplemental entry is not to be considered as a substitute for completion of mandatory reports, e.g., ENG Form 3394 and OSHA Form 200.

1.8.3.5 Features of Work

The Contractor shall include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

1.8.3.6 QC Requirements

The Contractor shall develop and maintain a complete list of QC testing,

transferred and installed property, and user training requirements in QCS. The Contractor shall update all data on these QC requirements as work progresses, and shall promptly provide this information to the Government via QCS.

1.8.4 Submittal Management

When available, the Government will provide the initial submittal register, ENG Form 4288, SUBMITTAL REGISTER, in electronic format. Thereafter, the Contractor shall maintain a complete list of all submittals, including completion of all data columns as described in Section 01330, SUBMITTAL PROCEDURES. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update, ENG Form 4288, shall be produced using QCS. RMS-W will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

1.8.5 Schedule

The Contractor shall develop a construction schedule consisting of pay activities, in accordance with Section 01320, PROJECT SCHEDULE, as applicable. This schedule shall be input and maintained in the QCS database either manually or by using the Standard Data Exchange Format (SDEF) (see Section 01320 PROJECT SCHEDULE). The updated schedule data shall be included with each pay request submitted by the Contractor.

1.8.6 Import/Export of Data

QCS includes the ability to export Contractor data to the Government and to import submittal register and other Government-provided data, and schedule data using SDEF.

1.9 IMPLEMENTATION

Contractor use of QCS as described in the preceding paragraphs is mandatory. The Contractor shall ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

1.10 DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM

The Government-preferred method for Contractor's submission of updates, payment requests, correspondence and other data is by E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of computer diskettes or CD-ROM for data transfer. Data on the disks or CDs shall be exported using the QCS built-in export function. If used, diskettes and CD-ROMs will be submitted in accordance with the following:

1.10.1 File Medium

The Contractor shall submit required data on 3-1/2" double-sided high-density diskettes formatted to hold 1.44 MB of data, capable of running under Microsoft Windows 95 or newer. Alternatively, CD-ROMs may be used. They shall conform to industry standards used in the United States. All data shall be provided in English.

1.10.2 Disk or CD-ROM Labels

The Contractor shall affix a permanent exterior label to each diskette and CD-ROM submitted. The label shall indicate in English, the QCS file name, full contract number, project name, project location, data date, name and telephone number of person responsible for the data.

1.10.3 File Names

The Government will provide the file names to be used by the Contractor with the QCS software.

1.11 MONTHLY COORDINATION MEETING

The Contractor shall update the QCS database each workday. At least monthly, the Contractor shall generate and submit an export file to the Government with schedule update and progress payment request. As required in Contract Clause "Payments", at least one week prior to submittal, the contractor shall meet with the Government representative to review the planned progress payment data submission for errors and omissions. The contractor shall make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be returned. The Government will not process progress payments until an acceptable QCS export file is received.

1.12 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SUBMITTAL REGISTER

CONTRACT NO.
PN50845/Am-0003

TITLE AND LOCATION VEHICLE PAINT & PREP SHOP						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REFERENCE NUMBER	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	GOVT CLASSIFICATION OR REFERENCE NUMBER	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
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			Precast/Prestressed Units	1.3													
			SD-06 Test Reports														
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		03415A	Erection Plan	3.10.5													
			Design Calculations	1.3.1.3													
			Concrete Mixture Proportions	2.2	G												
			Construction Records	3.11													
			SD-04 Samples														
			Precast Panel	1.4	G												
			SD-06 Test Reports														
			Materials	2.1													
			Concrete	1.3.2.2													
			SD-07 Certificates														
			Cement	2.1.1													
			Pozzolan														
			Air-Entraining Admixture	2.1.2.2													
			Water-Reducing Admixture	2.1.2.2													
			Accelerating Admixture	2.1.2.2													
			Aggregates	2.1.2.1													
			Air Content	1.3.2.3													
		05120	SD-02 Shop Drawings														
			Fabrication drawings	1.5.1													
			SD-03 Product Data														
			Shop primer	2.4													
			Load indicator washers	2.2.3													
			SD-06 Test Reports														
			Bolts, nuts, and washers	2.2													
			SD-07 Certificates														
			Steel	2.1													

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		05120	Bolts, nuts, and washers	2.2													
			Shop primer	2.4													
			Welding electrodes and rods	2.3.1													
			Welding procedures and qualifications	1.5.2.1													
		05400A	SD-07 Certificates														
			Mill Certificates														
		05500	SD-02 Shop Drawings														
			Steel Pipe Bollards														
			Canopy Framing														
			Stainless Steel Fixed Ladder														
			Stainless Steel Gratings														
			Fiberglass Reinforced Plastic Gratings														
			Stainless Steel Floor Plates														
			Stainless Steel Wall Panels														
		06100A	SD-07 Certificates														
			Grading and Marking	2.1.1													
		06200A	SD-02 Shop Drawings														
			Finish Carpentry														
			SD-03 Product Data														
			Plastic laminate														
			SD-04 Samples														
			Plastic laminate														
		06650	SD-02 Shop Drawings														
			Shop Drawings														

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		06650	Installation	3.2													
			SD-03 Product Data														
			Solid polymer material	2.1													
			Qualifications	1.6													
			Fabrications	2.3													
			SD-04 Samples														
			Material	2.1													
			Counter Tops	2.3.6													
			SD-06 Test Reports														
			Solid polymer material	2.1													
			SD-07 Certificates														
			Fabrications	2.3													
			Qualifications	1.6													
			SD-10 Operation and Maintenance														
			Data														
			Solid polymer material	2.1													
			Celean-up														
		07212N	SD-03 Product Data														
			Batt insulation	2.1													
			Accessories	2.2													
			SD-08 Manufacturer's Instructions														
			Insulation	3.2.1													
		07240	SD-02 Shop Drawings														
			Shop drawings	3.3													
			SD-03 Product Data														
			Sheathing board	2.2													

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		07240	Mechanical fasteners	2.3													
			Accessories	2.9													
			Base coat	2.4													
			Portland cement	2.5													
			Reinforcing fabric	2.6													
			Finish coat	2.7													
			Joint Sealant	2.10													
			Primer	2.8													
			Bond breaker	2.11													
			Backer Rod	2.12													
			Warranty	1.7													
			SD-04 Samples														
			Sample Boards	1.2.3.7	G												
			Mock-up Installation of EFS	1.2.1.4													
			SD-05 Design Data														
			Wind load	1.2.1.2													
			Moisture analysis	1.2.4													
			SD-06 Test Reports														
			Abrasion resistance	1.2.3.1													
			Accelerated weathering	1.2.3.2													
			Impact resistance	1.2.2.3													
			Mildew resistance	1.2.3.3													
			Salt spray resistance	1.2.3.4													
			vapor transmission	1.2.4													
			Absorption-freeze-thaw	1.2.3.6													
			Flame spread														

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		07240	Water penetration	1.2.1.1													
			Water resistance	1.2.3.5													
			Surface Burning Characteristics	1.2.2.1													
			Radiant heat	1.2.2.2													
			Substrate	3.1													
			Wind load	1.2.1.2													
			SD-07 Certificates														
			Qualifications of EFS	1.4.1													
			Manufacturer														
			Qualification of EFS Installer	1.4.2													
			Qualification of Sealant Applicator	1.4.3													
			Qualifications of Third Party														
			Inspector														
			Inspection Check List	3.5.1													
			SD-08 Manufacturer's Instructions														
			Installation	3.3													
			SD-10 Operation and Maintenance														
			Data														
			EFS	1.7													
		07412A	SD-02 Shop Drawings														
			Metal Roofing														
			SD-04 Samples														
			Accessories	2.2													
			Roof Panels	2.1													
			Fasteners	2.3													
			Gaskets	2.6													

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		07412A	Sealant	2.5													
			SD-07 Certificates														
			Roof Panels	2.1													
			Installation	3.1													
			Accessories	2.2													
			Installer	1.3.3													
			Warranties	1.7													
		07520	SD-03 Product Data														
			Acrylic roof coating														
			SD-04 Samples														
			Acrylic roof coating														
			SD-07 Certificates														
			Acrylic roof coating														
			SD-08 Manufacturer's Instructions														
			Manufacturer's material safety data sheets (MSDS)														
		07600	SD-02 Shop Drawings														
			Gutters	3.1.9													
			Downspouts	3.1.10													
			Expansion joints														
			Flashing at roof penetrations	3.1.13													
			SD-11 Closeout Submittals														
			Quality Control Plan	3.4													
		07840A	SD-02 Shop Drawings														
			Firestopping Materials	2.1													
			SD-07 Certificates														

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		07840A	Firestopping Materials	2.1													
			Installer Qualifications	1.5													
			Inspection	3.3													
		07900A	SD-03 Product Data														
			Backing	2.1													
			Bond-Breaker	2.2													
			Sealant	2.4													
			SD-07 Certificates														
			Sealant	2.4													
		08115	SD-02 Shop Drawings														
			Doors	2.1													
			Frames	2.4													
			Accessories	2.2													
			SD-03 Product Data														
			Doors	2.1													
			Frames	2.4													
			Accessories	2.2													
		08210	SD-02 Shop Drawings														
			Doors	2.1													
			SD-03 Product Data														
			Doors	2.1													
			Accessories	2.2													
			warranty	1.4													
			SD-04 Samples														
			Doors	2.1													
		08330A	SD-02 Shop Drawings														

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		08330A	Approved Detail Drawings	3.1													
			Installation	3.1													
			SD-03 Product Data														
			Stainless Steel Overhead Rolling	2.1													
			Doors														
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	1.6													
			Manuals														
		08560	SD-02 Shop Drawings														
			Windows	2.2.1													
			SD-03 Product Data														
			Windows	2.2.1													
			Fasteners	2.4.4													
			Accessories	2.4.5													
			SD-04 Samples														
			Windows	2.2.1	G												
			SD-10 Operation and Maintenance														
			Data														
			Windows	2.2.1													
		08710	SD-02 Shop Drawings														
			Hardware schedule	1.3	G												
			Keying System	2.3.5	G												
			SD-03 Product Data														
			Hardware items	2.3													
			SD-08 Manufacturer's Instructions														

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		08710	Installation	3.1													
			SD-11 Closeout Submittals														
			Key biting	1.4													
		08810A	SD-03 Product Data														
			Insulating Glass	2.1													
			Glazing Accessories	2.4													
			SD-04 Samples														
			Insulating Glass	2.1													
			SD-07 Certificates														
			Insulating Glass	2.1													
		09100N	SD-02 Shop Drawings														
			Metal support systems	2.1													
		09215	SD-03 Product Data														
			Gypsum base	2.1.2													
			Gypsum veneer plaster	2.1.3													
		09250	SD-03 Product Data														
			Cementitious backer units	2.1.4													
			Water-Resistant Gypsum Backing Board	2.1.2													
			Accessories	2.1.7													
			SD-07 Certificates														
			Asbestos Free Materials	2.1													
		09310	SD-03 Product Data														
			Tile	2.1													
			Setting-Bed	2.2													
			Mortar and Grout	2.4													

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		09310	SD-04 Samples														
			Tile	2.1													
			Accessories	2.1.3													
			Marble Thresholds	2.5													
			SD-06 Test Reports														
			Testing														
			SD-07 Certificates														
			Tile	2.1													
			Mortar and Grout	2.4													
		09510	SD-02 Shop Drawings														
			Approved Detail Drawings	1.3													
			SD-03 Product Data														
			Acoustical Ceiling Systems														
			SD-04 Samples														
			Acoustical Units	2.1													
			SD-06 Test Reports														
			Ceiling Attenuation Class and Test	1.3.1													
			SD-07 Certificates														
			Acoustical Units	2.1													
		09650	SD-02 Shop Drawings														
			Tile Flooring	2.1													
			SD-03 Product Data														
			Tile Flooring	2.1													
			Adhesive for Vinyl Composition	2.1.2													
			Tile														

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		09650	Adhesive for Wall Base	2.1.3													
			SD-04 Samples														
			Tile Flooring	2.1	G												
			Wall Base	2.3	G												
			SD-06 Test Reports														
			Moisture Test	3.3													
			SD-08 Manufacturer's Instructions														
			Tile Flooring	2.1													
			SD-10 Operation and Maintenance														
			Data														
			Tile Flooring	2.1													
		09900	SD-03 Product Data														
			Coating	2.1													
			Manufacturer's Technical Data	2.1													
			Sheets														
			SD-04 Samples														
			Color	1.9	G												
			SD-07 Certificates														
			Applicator's qualifications	1.3													
			Qualification Testing	1.4.1.2													
			SD-08 Manufacturer's Instructions														
			Application instructions														
			Mixing	3.6.2													
			Manufacturer's Material Safety	1.7.2													
			Data Sheets														

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		09900	SD-10 Operation and Maintenance Data														
			Coatings	2.1													
		10153	SD-02 Shop Drawings Toilet Partition System														
			SD-03 Product Data Toilet Partition System														
			SD-04 Samples Toilet Partition System														
		10201	SD-02 Shop Drawings Metal Wall Louvers	2.1													
			SD-03 Product Data Metal Wall Louvers	2.1													
		10260	SD-02 Shop Drawings Corner Guards	2.2													
			SD-03 Product Data Corner Guards	2.2													
			SD-04 Samples Finish	2.3	G												
			SD-06 Test Reports Corner Guards	2.2													
			SD-07 Certificates Corner Guards	2.2													
		10430	SD-02 Shop Drawings Approved Detail Drawings	3.1													
			SD-04 Samples														

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		10430	Exterior Signs														
			SD-10 Operation and Maintenance Data														
			Protection and Cleaning														
		10440	SD-02 Shop Drawings														
			Detail Drawings	3.1													
			SD-03 Product Data														
			Installation	3.1													
			SD-04 Samples														
			Interior Signage	1.3	G												
		10505	SD-02 Shop Drawings														
			Solid plastic lockers	2.1													
			SD-03 Product Data														
			Solid plastic lockers	2.1													
			SD-04 Samples														
			Solid plastic lockers	2.1													
		10520	SD-03 Product Data														
			Fire Extinguishers														
			Fire Extinguisher Cabinets														
		10800	SD-03 Product Data														
			Finishes	2.1.2													
			Accessory Items	2.2													
			SD-04 Samples														
			Finishes	2.1.2													
			Accessory Items	2.2													
			SD-07 Certificates														

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		10800	Accessory Items	2.2													
		11312	SD-03 Product Data														
			Pipe and fittings														
			Check valves														
			Gate valves														
			Submersible sewage pumps														
			Pump motor														
			Flexible flanged coupling														
			SD-10 Operation and Maintenance														
			Data														
			Submersible Sewage Pumps														
		11502	SD-02 Shop Drawings														
			Paint spray booth														
			Air intake system														
			Exhaust system with 3-stage paint														
			arrestor filter system														
			Electric automatic roll-up metal														
			doors with manual override														
			Lighting system														
			Breathing air supply system and														
			pipng to paint booth														
			Compressed (service) air supply														
			pipng to paint booth														
			Electrical Controls, Alarms &														
			Starter Disconnect														

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		11502	Two-stage air makeup pocket salt filter and paint booth ceiling air makeup filter system														
			Electrical Distribution System														
			SD-03 Product Data														
			Paint Spray Booth														
			Air Intake System														
			Exhaust System with 3-stage														
			Paint arrestor Filter system														
			Electric Automatic Roll-up Metal														
			Doors with manual override														
			Lighting System														
			Breathing Air Supply System,														
			purifiers, carbon monoxide monitor,														
			alarm, filter, and hoses														
			Spare Parts Data														
			Posted Instructions														
			Verification of Dimensions														
			System Performance Test														
			Demonstrations														
			SD-05 Design Data														
			Paint Spray Booth - Side-Draft														
			Calculations														
			SD-06 Test Reports														
			System Performance Tests														

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		11502	SD-10 Operation and Maintenance														
			Data														
			Operation Manuals														
			Maintenance Manuals														
		11503	SD-02 Shop Drawings														
			Abrasive Blast Room														
			Recovery System														
			Equipment Room														
			Dust Collector														
			Salt Filter Air Makeup System and														
			Ductwork														
			Air Intake System														
			SD-03 Product Data														
			Dust Collector														
			Recovery System														
			Abrasive Reclaim Machine														
			Blast Machine														
			Operator Safety Gear														
			Storage Hopper														
			Spare Parts Data														
			Posted Instructions														
			Verification of Dimensions														
			System Performance Test														
			Demonstrations														
			SD-05 Design Data														
			Dust Collector														

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		11503	Grit recovery system														
			Abrasive reclaim machine														
			Blast machine														
			Abrasive Calculations														
			SD-06 Test Reports														
			System Performance Tests														
			SD-07 Certificates														
			Abrasive Blast System														
			SD-10 Operation and Maintenance														
			Data														
			Operation Manuals														
			Maintenance Manuals														
		11504	SD-02 Shop Drawings														
			Hydro Blast System														
			Residue Collector														
			SD-03 Product Data														
			Spare Parts Data														
			Posted Instructions														
			Verification of Dimensions														
			System Performance Test														
			Demonstrations														
			SD-06 Test Reports														
			System Performance Tests														
			SD-07 Certificates														
			Hydro Blast System														

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		11504	SD-10 Operation and Maintenance														
			Data														
			Operation Manuals														
			Maintenance Manuals														
		11505	SD-03 Product Data														
			Metalization Booth (acoustical)														
			Make up air system														
			Dust Collector														
			Electric acoustical automatic														
			Roll-up Metal Doors with manual override														
			Lighting System														
			Breathing Air purifiers and supply air piping to Metalization Booth														
			Compressed (Service) Air Supply Piping to Paint Booth														
			Electrical Controls, Alarms & Starter Disconnect														
			Two-stage Air Makeup Pocket														
			Salt Filter and Metalization Booth														
			Air Makeup Filter System														
			Spare Parts Data														
			Posted Instructions														
			Verification of Dimensions														
			System Performance Test														
			Demonstrations														

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		11505	SD-05 Design Data														
			Metalization Booth - Ventilation														
			Calculations														
			SD-06 Test Reports														
			System Performance Tests														
			Metalization Booth														
			Dust Collector														
			Breathing Air Supply System,														
			purifiers, carbon monoxide monitor,														
			alarm, filter, and hoses														
			SD-07 Certificates														
			Metalization Booth														
			Dust Collector														
			SD-10 Operation and Maintenance														
			Data														
			Operation Manuals														
			Maintenance Manuals														
			Metalization Booth														
			Dust Collector														
			Electrical Controls, Alarms &														
			Starter Disconnect														
			Electric acoustical automatic														
			Roll-up Metal Doors with manual														
			override														
			Posted Operating Instructions														
		12490A	SD-02 Shop Drawings														

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		12490A	Approved Detail Drawings	3.1													
			SD-03 Product Data														
			Window Treatments	3.1													
			Hardware	1.3													
			SD-04 Samples														
			Window Treatments	3.1													
		13080	SD-02 Shop Drawings														
			Bracing	3.1													
			Resilient Vibration Isolation	3.4													
			Devices														
			Equipment Requirements	1.4													
			SD-03 Product Data														
			Bracing	3.1													
			Equipment Requirements	1.4													
		13281A	SD-03 Product Data														
			Materials and Equipment	1.18													
			Expendable Supplies	1.19													
			Qualifications	1.5	G												
			SD-06 Test Reports														
			Pressure Differential Log	3.1.3													
			Licences, Permits, and		G												
			Notifications														
			Accident Prevention Plan (APP)	1.7	G												
			Sampling and Analysis	1.13	G												
			Clearance Report	3.7	G												
		13286N	SD-07 Certificates														

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		13286N	Qualifications of CIH	1.8.1	G												
			Training Certification	1.8.1	G												
			PCB and Lamp Removal Work Plan	1.8.2	G												
			PCB and Lamp Disposal Plan	1.8.3	G												
			SD-11 Closeout Submittals														
			Transporter certification	3.5.2	G												
			Certification of Decontamination	3.2.4													
			Certificate of Disposal and/or recycling	3.5.2.1													
			Testing results														
		13851A	SD-02 Shop Drawings														
			Fire Alarm Reporting System	1.4.1	G												
			SD-03 Product Data														
			Storage Batteries	2.2	G												
			Voltage Drop		G												
			Special Tools and Spare Parts	2.7.3	G												
			Technical Data and Computer Software	1.5	G												
			Training	3.6	G												
			Testing	3.5	G												
			SD-06 Test Reports														
			Testing	3.5	G												
			SD-07 Certificates														
			Equipment		G												
			Qualifications	1.3.7	G												

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		13851A	SD-10 Operation and Maintenance														
			Data														
			Technical Data and Computer	1.5	G												
			Software														
		13920A	SD-02 Shop Drawings														
			Installation Requirements	3.3	G												
			As-Built Drawings		G												
			SD-03 Product Data														
			Fire Pump Installation Related	3.1	G												
			Submittals														
			Installation Requirements	3.3	G												
			Spare Parts		G												
			Preliminary Test	3.8.2	G												
			System Diagrams		G												
			Fire Protection Specialist	1.9	G												
			Manufacturer's Representative	1.10	G												
			Field Training	3.10	G												
			Final Acceptance Test	3.8.3	G												
			SD-06 Test Reports														
			Preliminary Test	3.8.2	G												
			Final Acceptance Test	3.8.3	G												
			SD-07 Certificates														
			Qualifications of Installer		G												
			Fire Protection Specialist	1.9	G												
			SD-10 Operation and Maintenance														
			Data														

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		13920A	Fire Pumps	3.8.2	G												
		13930A	SD-02 Shop Drawings														
			Shop Drawings	1.12	G												
			As-Built Drawings	3.11	G												
			SD-03 Product Data														
			Fire Protection Related Submittals	3.1	G												
			Sway Bracing	3.4.1	G												
			Materials and Equipment	2.3	G												
			Hydraulic Calculations	1.7	G												
			Spare Parts	1.11	G												
			Preliminary Tests	3.10	G												
			Final Acceptance Test	3.11	G												
			On-site Training	3.12	G												
			Fire Protection Specialist	1.8	G												
			Sprinkler System Installer	1.9	G												
			SD-06 Test Reports														
			Preliminary Test Report	3.11	G												
			Final Acceptance Test Report	3.11	G												
			SD-07 Certificates														
			Inspection by Fire Protection Specialist	3.3	G												
			SD-10 Operation and Maintenance Data														
			Operating and Maintenance Instructions	3.12	G												
		15070A	SD-02 Shop Drawings														

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		15070A	Coupling and Bracing	3.1													
			Flexible Couplings or Joints	3.3													
			Equipment Requirements	1.3													
			Contractor Designed Bracing	1.2.4													
			SD-03 Product Data														
			Coupling and Bracing	3.1													
			Equipment Requirements	1.3													
			Contractor Designed Bracing	1.2.4													
			SD-07 Certificates														
			Flexible Ball Joints	2.2													
		15080A	SD-02 Shop Drawings														
			Mica Plates	3.2.2.4													
			SD-03 Product Data														
			General Materials	2.1													
			SD-04 Samples														
			Thermal Insulation Materials														
		15182A	SD-02 Shop Drawings														
			Refrigerant Piping System	2.3													
			SD-03 Product Data														
			Materials and Equipment	2.1													
			Spare Parts	1.6.3													
			Qualifications	1.3													
			Refrigerant Piping Tests	3.3													
			Demonstrations	3.4													
			Verification of Dimensions	1.6.1													
			SD-06 Test Reports														

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		15182A	Refrigerant Piping Tests	3.3													
			SD-07 Certificates														
			Service Organization	2.1													
			SD-10 Operation and Maintenance														
			Data														
			Operation Manual	3.3													
			Maintenance Manuals	3.4													
		15400A	SD-02 Shop Drawings														
			Plumbing System	3.8.1													
			Electrical Work	1.4													
			SD-03 Product Data														
			Welding	1.5.1													
			Plumbing Fixture Schedule	3.9													
			Vibration-Absorbing Features	3.4													
			Plumbing System	3.8.1													
			SD-06 Test Reports														
			Tests, Flushing and Disinfection	3.8													
			Test of Backflow Prevention	3.8.1.1													
			Assemblies														
			SD-07 Certificates														
			Materials and Equipment	1.3													
			Bolts	2.1.1													
			SD-10 Operation and Maintenance														
			Data														
			Plumbing System	3.8.1													
		15700A	SD-02 Shop Drawings														

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		15700A	Drawings														
			SD-03 Product Data														
			Unitary Equipment, Rooftop	2.4													
			Package System (RTU-1)														
			Unitary Equipment, Rooftop	2.5													
			Package System (RTU-2)														
			Spare Parts Data														
			Posted Instructions	3.5													
			Verification of Dimensions	1.5.1													
			System Performance Tests	3.4													
			Demonstrations	3.5													
			SD-06 Test Reports														
			Refrigerant Tests, Charging, and	3.3													
			Start-Up														
			System Performance Tests	3.4													
			SD-07 Certificates														
			Unitary Equipment, Rooftop	2.4													
			Package System (RTU-1)														
			Unitary Equipment, Rooftop	2.5													
			Package System (RTU-2)														
			Service Organization	2.1													
			SD-10 Operation and Maintenance														
			Data														
			Operation Manuals														
			Maintenance Manuals	3.5													
		15895	SD-02 Shop Drawings														

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		15895	Drawings	3.1.4													
			Installation	3.1													
			SD-03 Product Data														
			Components and Equipment	2.1													
			Test Procedures														
			Welding Procedures														
			Diagrams	3.1													
			Manufacturer's Exerience														
			Welded Joints														
			Performance Tests	3.4													
			Field Training	3.6													
			SD-06 Test Reports														
			Performance Tests	3.4													
			Testing, Adjusting, and Balancing	3.3													
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SECTION 02111

EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 698	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(2000) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996e1) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 5434	(1997) Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 302	Designation, Reportable Quantities, and Notification
29 CFR 1926	Safety and Health Regulations for Construction

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) U.S. Army Corps of Engineers Safety and Health Requirements Manual
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1.2 MEASUREMENT AND PAYMENT

1.2.1 Measurement

Measurement for excavation and on-site transportation shall be based on the actual number of cubic meters of contaminated material in-place prior to excavation. Determination of the volume of contaminated material excavated shall be based on cross-sectional volume determination reflecting the differential between the original elevations of the top of the contaminated material and the final elevations after removal of the contaminated material. Measurement for backfilling of excavated areas shall be based on in-place cubic meters of compacted fill. Measurement for construction of stockpile areas shall be based on the number of square meters of stockpile liner constructed.

1.2.2 Payment

1.2.2.1 Excavation and Transportation

Compensation for excavation and onsite transportation of contaminated material will be paid as a unit cost. This unit cost shall include any other items incidental to excavation and handling not defined as having a specific unit cost.

1.2.2.2 Backfilling

Compensation for backfill soil, transportation of backfill, backfill soil conditioning, backfilling, compaction, and geotechnical testing will be paid as a single unit cost.

1.2.2.3 Stockpiling

Compensation for construction of stockpile areas will be paid for as a unit cost. This unit cost shall include all aspects of grading, preparation, handling, placement, maintenance, removal, treatment, and disposal of stockpile cover materials and liner materials and all other items incidental to construction of stockpiles.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Surveys; G

Separate cross-sections of each area before and after excavation and after backfilling.

SD-03 Product Data

Excavation and Handling Work Plan; G

Work Plan within 30 calendar days after notice to proceed. No work at the site, with the exception of site inspections and

surveys, shall be performed until the Work Plan is approved. The Contractor shall allow 30 calendar days in the schedule for the Government's review. No adjustment for time or money will be made if resubmittals of the Work Plan are required due to deficiencies in the plan. At a minimum, the Work Plan shall include:

- a. Schedule of activities.
- b. Method of excavation and equipment to be used.
- c. Shoring or side-wall slopes proposed.
- d. Dewatering plan.
- e. Storage methods and locations for liquid and solid contaminated material.
- f. Borrow sources and haul routes.
- g. Decontamination procedures.
- h. Spill contingency plan.

Closure Report; G

Ten copies of the Closure Report within 30 calendar days of work completion at the site.

SD-06 Test Reports

Backfill; G
Surveys; G
Confirmation Sampling and Analysis; G
Sampling of Stored Material; G
Sampling Liquid; G
Compaction; G

Test results.

1.4 SURVEYS

Surveys shall be performed immediately prior to and after excavation of contaminated material to determine the volume of contaminated material removed. Surveys shall also be performed immediately after backfill of each excavation. The Contractor shall provide cross-sections on 3 meter intervals and at break points for all excavated areas. Locations of confirmation samples shall also be surveyed and shown on the drawings.

1.5 REGULATORY REQUIREMENTS

1.5.1 Permits and Licenses

The Contractor shall obtain required federal, state, and local USAKA/RTS permits for excavation and storage of contaminated material. Permits shall be obtained at no additional cost to the Government.

1.5.2 Air Emissions

Air emissions shall be monitored and controlled in accordance with Section

01430 ENVIRONMENTAL PROTECTION.

1.6 DESCRIPTION OF WORK

The work shall consist of excavation and temporary storage of an unknown quantity of contaminated material. **Based on past excavations in the project area, contaminated material may be encountered during excavation work required to remove the existing fuel line.** The Contracting Officer shall be notified within 24 hours, and before excavation, if contaminated material is discovered that has not been previously identified or if other discrepancies between data provided and actual field conditions are discovered. Backfill material is not available onsite. Ground water is approximately one to 2 meters below pre-excavation ground surface.

1.7 CHEMICAL TESTING

Required sampling and chemical analysis shall be conducted in accordance with paragraph entitled "SAMPLING" hereinbelow.

1.8 SCHEDULING

The Contractor shall notify the Contracting Officer 10 calendar days prior to the start of excavation of contaminated material. The Contractor shall be responsible for contacting regulatory agencies in accordance with the applicable reporting requirements.

PART 2 PRODUCTS

2.1 BACKFILL

Backfill material shall be obtained from offsite sources approved by the Contracting Officer. Backfill shall be classified in accordance with ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC, ML, MH, CL, or CH and shall be free from roots and other organic matter, trash, or debris. Backfill material shall be tested for the parameters listed below at a frequency of once per 3000 cubic meters. A minimum of one set of classification tests shall be performed per borrow source. One backfill sample per borrow source shall also be collected and tested for the chemical parameters listed below.

<u>Physical Parameter</u>	<u>Criteria</u>	<u>Test Method</u>
Grain Size	USAKA/RTS	ASTM D 422
Compaction	USAKA/RTS	ASTM D 698
<u>Chemical Parameter</u>	<u>Test Frequency</u>	<u>Criteria</u>
TPH, RCRA 8 metals PAH, PCB	One per source	USAKA/RTS

Backfill shall not be used until borrow source chemical and physical test results have been submitted and approved.

2.2 SPILL RESPONSE MATERIALS

The Contractor shall provide appropriate spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment. Spill response materials shall

be available at all times when contaminated materials/wastes are being handled or transported. Spill response materials shall be compatible with the type of materials and contaminants being handled.

PART 3 EXECUTION

3.1 EXISTING STRUCTURES AND UTILITIES

No excavation shall be performed until site utilities have been field located. The Contractor shall take the necessary precautions to ensure no damage occurs to existing structures and utilities. Damage to existing structures and utilities resulting from the Contractor's operations shall be repaired at no additional cost to the Government. Utilities encountered that were not previously shown or otherwise located shall not be disturbed without approval from the Contracting Officer.

3.2 CONTAMINATED MATERIAL REMOVAL

3.2.1 Excavation

Areas of contamination shall be excavated to the depth and extent shown on the drawings and not more than 300 mm beyond the depth and extent shown on the drawings unless directed by the Contracting Officer. Excavation shall be performed in a manner that will limit spills and the potential for contaminated material to be mixed with uncontaminated material. An excavation log describing visible signs of contamination encountered shall be maintained for each area of excavation. Excavation logs shall be prepared in accordance with ASTM D 5434.

3.2.2 Shoring

If workers must enter the excavation, it shall be evaluated, shored, sloped or braced as required by EM 385-1-1 and 29 CFR 1926 section 650.

3.2.3 Dewatering

Surface water shall be diverted to prevent entry into the excavation. Dewatering shall be limited to that necessary to assure adequate access, a safe excavation, prevent the spread of contamination, and to ensure that compaction requirements can be met. No dewatering shall be performed without prior approval of the Contracting Officer.

3.3 CONFIRMATION SAMPLING AND ANALYSIS

The Contracting Officer shall be present to inspect the removal of contaminated material from each site. After all material suspected of being contaminated has been removed, the excavation shall be examined for evidence of contamination. If the excavation appears to be free of contamination, field analysis shall be used to determine the presence of total petroleum hydrocarbons (TPH) contamination using immunoassay field kits. Excavation of additional material shall be as directed by the Contracting Officer. After all suspected contaminated material is removed, confirmation samples shall be collected and analyzed for the following contaminants:

<u>Chemical Parameter</u>	<u>Action Level</u>
TPH	USAKA/RTS

Samples shall be collected at a frequency of one per 9 square meters from the bottom and each of the side walls or as directed by the Contracting Officer. A minimum of one sample shall be collected from the bottom and each side wall of the excavation. Based on test results, the Contractor shall propose any additional excavation which may be required to remove material which is contaminated above action levels. Additional excavation shall be subject to approval by the Contracting Officer. Locations of samples shall be marked in the field and documented on the as-built drawings.

3.4 CONTAMINATED MATERIAL STORAGE

Material shall be placed in temporary storage immediately after excavation. The following paragraphs describe acceptable methods of material storage. Storage units shall be in good condition and constructed of materials that are compatible with the material or liquid to be stored. If multiple storage units are required, each unit shall be clearly labeled with an identification number and a written log shall be kept to track the source of contaminated material in each temporary storage unit.

3.4.1 Stockpiles

Stockpiles shall be constructed to isolate stored contaminated material from the environment. The maximum stockpile size shall be 1,000 cubic meters. Stockpiles shall be constructed to include:

- a. A chemically resistant geomembrane liner free of holes and other damage. Non-reinforced geomembrane liners shall have a minimum thickness of 0.5 mm. Scrim reinforced geomembrane liners shall have a minimum weight of 20 kg/100 square meters. The ground surface on which the geomembrane is to be placed shall be free of rocks greater than 12 mm in diameter and any other object which could damage the membrane.
- b. Geomembrane cover free of holes or other damage to prevent precipitation from entering the stockpile. Non-reinforced geomembrane covers shall have a minimum thickness of 0.25 mm. Scrim reinforced geomembrane covers shall have a minimum weight of 13 kg/100 square meters. The cover material shall be extended over the berms and anchored or ballasted to prevent it from being removed or damaged by wind.
- c. Berms surrounding the stockpile, a minimum of 300 mm in height. Vehicle access points shall also be bermed.
- d. The liner system shall be sloped to allow collection of leachate. Storage and removal of liquid which collects in the stockpile, in accordance with paragraph Liquid Storage.

3.4.2 Roll-Off Units

Roll-off units used to temporarily store contaminated material shall be water tight. A cover shall be placed over the units to prevent precipitation from contacting the stored material. The units shall be located at USAKA/RTS-designated areas. Liquid which collects inside the units shall be removed and stored in accordance with paragraph Liquid Storage.

3.4.3 Liquid Storage

Liquid collected from excavations and stockpiles shall be temporarily stored in USAKA-approved tanks or barrels. Liquid storage containers shall be water-tight and shall be located at USAKA-designated area(s).

3.5 SAMPLING

3.5.1 Sampling of Stored Material

Samples of stored material shall be collected at a frequency of once per one cubic meter. Samples shall be tested for the following:

<u>Chemical Parameter</u>	<u>Action Level</u>
TPH as indicator compound	USAKA

Stored material with contaminant levels that exceed the action levels shall be treated offsite. Analyses for contaminated material to be taken to an offsite treatment facility shall conform to local, USAKA/KMR, and federal criteria as well as to the requirements of the treatment facility. Documentation of all analyses performed shall be furnished to the Contracting Officer. Additional sampling and analyses to the extent required by the approved offsite treatment, storage or disposal (TSD) facility shall be the responsibility of the Contractor and shall be subject to approval by the Contracting Officer. Treatment plan shall be submitted to and approved by USAKA Environmental Office.

3.5.2 Sampling Liquid

Liquid collected from excavations, storage areas, and decontamination facilities shall be sampled at a frequency of once for every 2,000 L of liquid collected. Samples shall be tested for the following:

<u>Chemical Parameter</u>	<u>Action Level</u>
TPH as indicator compound	USAKA

Liquid with contaminant levels that exceed action levels shall be treated offsite. Analyses for contaminated liquid to be taken to an offsite treatment facility shall conform to local, USAKA/KMR, and federal criteria as well as to the requirements of the treatment facility. Documentation of all analyses performed shall be furnished to the Contracting Officer. Additional sampling and analysis to the extent required by the approved offsite treatment, storage or disposal (TSD) facility receiving the material shall be the responsibility of the Contractor and shall be subject to approval by the Contracting Officer. Treatment plan shall be submitted to and approved by USAKA Environmental Office.

3.5.3 Sampling Beneath Storage Units

Samples from beneath each storage unit shall be collected prior to construction of and after removal of the storage unit. Samples shall be collected at a frequency of one per each one square meter from a depth interval of 0 to 0.15 m and shall be tested for the following:

<u>Chemical Parameter</u>	<u>Action Level</u>
TPH as indicator compound	USAKA

Based on test results, soil which has become contaminated above action levels shall be removed as directed by the Contracting Officer. Contaminated material which is removed from beneath the storage unit shall be handled in accordance with paragraph Sampling of Stored Material. As directed by the Contracting Officer and based on field observations and/or testing, additional sampling and testing shall be performed to verify areas of contamination found beneath stockpiles have been cleaned up to below action levels.

3.6 SPILLS

In the event of a spill or release of a hazardous substance (as designated in 40 CFR 302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), the Contractor shall notify the Contracting Officer immediately. If the spill exceeds the reporting threshold, the Contractor shall follow the pre-established procedures as described in the Base Wide Contingency Plan for immediate reporting and containment. Immediate containment actions shall be taken to minimize the effect of any spill or leak. Cleanup shall be in accordance with applicable federal, USAKA/KMR, and local regulations. As directed by the Contracting Officer, additional sampling and testing shall be performed to verify spills have been cleaned up. Spill cleanup and testing shall be done at no additional cost to the Government.

3.7 BACKFILLING

3.7.1 Confirmation Test Results

Excavations shall be backfilled immediately after all contaminated materials have been removed and confirmation test results have been approved. Backfill shall be placed and compacted to the lines and grades shown on the drawings.

3.7.2 Compaction

Approved backfill shall be placed in lifts with a maximum loose thickness of 200 mm. Soil shall be compacted to 90 percent of ASTM D 698 maximum dry density. Density tests shall be performed at a frequency of once per 930 square meters per lift. A minimum of one density test shall be performed on each lift of backfill placed. Field in-place dry density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. If ASTM D 2922 is used, a minimum of one in ten tests shall be checked using ASTM D 1556 or ASTM D 2167. Test results from ASTM D 1556 or ASTM D 2167 shall govern if there is a discrepancy with the ASTM D 2922 test results.

3.8 DISPOSAL REQUIREMENTS

Offsite disposal of contaminated material shall be in accordance with Section 02120A TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS.

3.9 CLOSURE REPORT

Ten copies of a Closure Report shall be prepared and submitted within 30

calendar days of completing work at the site. The report shall be labeled with the contract number, project name, location, date, name of general contractor, and the Corps of Engineers District contracting for the work. The Closure Report shall include the following information as a minimum:

- a. A cover letter signed by a responsible company official certifying that all services involved have been performed in accordance with the terms and conditions of the contract documents and regulatory requirements.
- b. A narrative report including, but not limited to, the following:
 - (1) site conditions, ground water elevation, and cleanup criteria;
 - (2) excavation logs;
 - (3) field screening readings;
 - (4) quantity of materials removed from each area of contamination;
 - (5) quantity of water/product removed during dewatering;
 - (6) sampling locations and sampling methods;
 - (7) sample collection data such as time of collection and method of preservation;
 - (8) sample chain-of-custody forms; and
 - (9) source of backfill.
- c. Copies of all chemical and physical test results.
- d. Copies of all manifests and land disposal restriction notifications.
- e. Copies of all certifications of final disposal signed by the responsible disposal facility official.
- f. Waste profile sheets.
- g. Scale drawings showing limits of each excavation, limits of contamination, known underground utilities within 15 m of excavation, sample locations, and sample identification numbers. On-site stockpile, storage, treatment, loading, and disposal areas shall also be shown on the drawings.
- h. Progress Photographs. Color photographs shall be used to document progress of the work. A minimum of four views of the site showing the location of the area of contamination, entrance/exit road, and any other notable site conditions shall be taken before work begins. After work has been started, activities at each work location shall be photographically recorded daily. Photographs shall be a minimum of 76.2 x 127.0 mm and shall include:
 - (1) Soil removal and sampling.
 - (2) Dewatering operations.

- (3) Unanticipated events such as spills and the discovery of additional contaminated material.
- (4) Contaminated material/water storage, handling, treatment, and transport.
- (5) Site or task-specific employee respiratory and personal protection.
- (6) Fill placement and grading.
- (7) Post-construction photographs. After completion of work at each site, the Contractor shall take a minimum of four views of each excavation site.

A digital version of all photos shown in the report shall be included with the Closure Report. Photographs shall be a minimum of 76 mm by 127 mm and shall be mounted back-to-back in double face plastic sleeves punched to fit standard three ring binders. Each print shall have an information box attached. The box shall be typewritten and arranged as follows:

Project Name: _____	Direction of View: _____
Location: _____	Date/Time: _____
Photograph No.: _____	Description of View: _____

-- End of Section --

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DIVISION 09 - FINISHES

SECTION 09215

VENEER PLASTER

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- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS
- 1.4 DELIVERY AND STORAGE
- 1.5 SCHEDULING
- 1.6 ENVIRONMENTAL REQUIREMENTS

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 - 2.1.1 Steel Framing, Furring, and Related Items
 - 2.1.2 Gypsum Base
 - 2.1.3 Gypsum Veneer Plaster
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- 3.2 APPLICATION OF GYPSUM BASE
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SECTION 09215

veneer plaster

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 475/C 475M	(2002) Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C 587	(2002) Gypsum Veneer Plaster
ASTM C 588/C 588M	(2001; Rev. A) Gypsum Base for Veneer Plasters
ASTM C 645	(2000) Nonstructural Steel Framing Members
ASTM C 754	(2000) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
ASTM C 843	(1999) Application of Gypsum Veneer Plaster
ASTM C 844	(1999) Application of Gypsum Base to Receive Gypsum Veneer Plaster
ASTM C 954	(2000) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
ASTM C 1002	(2001; Rev. A) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases
ASTM D 3678	(1997) Rigid Poly (Vinyl Chloride) (PVC) Interior-Profile Extrusions
ASTM E 84	(2001) Surface Burning Characteristics of Building Materials

1.2 GENERAL REQUIREMENTS

Except where otherwise indicated or specified, conform to ASTM C 843 and ASTM C 844. Apply the gypsum veneer plaster as a one coat system over a special gypsum base. The veneer plaster, gypsum base, and joint reinforcement shall be products of the same manufacturer. The extent and location of veneer plaster shall be as shown on the drawings.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Gypsum base

Gypsum veneer plaster

Descriptive data and installation instructions.

1.4 DELIVERY AND STORAGE

Deliver and store plaster materials in the manufacturer's original unopened containers. Store materials off the ground within a completely enclosed structure or enclosed within a weathertight covering. Store gypsum base and gypsum backing board flat to prevent warping and protect from excessive exposure to sunlight.

1.5 SCHEDULING

Commence application only after the area scheduled for veneer plaster work is completely weathertight. The ventilating and air-conditioning systems should be complete and in operation prior to application of the plaster. If the mechanical system cannot be activated before veneer plastering is begun, the plastering may proceed in accordance with an approved plan to maintain the environmental conditions specified below. Apply plaster prior to the installation of finish flooring and acoustic ceiling.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not expose the gypsum base to excessive sunlight prior to plaster application, as bond failure of the plaster may result. Maintain a continuous uniform temperature of not less than 15 degrees C and not more than 27 degrees C for at least one week prior to the application of veneer plaster, while the plastering is being done, and for at least one week after the plaster is set. Shield air supply and distribution devices to prevent any uneven flow of air across the plastered surfaces. Provide ventilation to exhaust moist air to the outside during plaster application and set, and until plaster is dry. In glazed areas, keep windows open top and bottom or side to side 75 to 100 mm. For enclosed areas lacking natural ventilation, provide temporary mechanical means for ventilation. In unglazed areas subjected to hot, dry winds or temperature differentials from day to night of 15 degrees C or more, screen openings with cheesecloth or similar materials. Avoid rapid drying. During periods of low indoor humidity, provide minimum air circulation following plastering and until plaster is dry.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the requirements specified below. Miscellaneous items not otherwise specified shall be as recommended by the veneer plaster system manufacturer and approved prior to use. Powder driven fasteners may be used only when approved in writing. **Veneer plaster shall be Class A, B, or C finish when tested in accordance with ASTM E 84.**

2.1.1 Steel Framing, Furring, and Related Items

ASTM C 645.

2.1.2 Gypsum Base

ASTM C 588/C 588M, Type X, 1200 mm wide, thickness as shown. Provide square edges, rounded, or tapered as recommended by the veneer plaster manufacturer.

2.1.3 Gypsum Veneer Plaster

ASTM C 587. Minimum compressive strength of finish coat plaster shall be 17 MPa.

2.1.4 Joint Reinforcement

ASTM C 475/C 475M, Mesh reinforcing strip or paper tape as recommended by the veneer plaster manufacturer.

2.1.5 Joint Compound

ASTM C 475/C 475M.

2.1.6 Screws

ASTM C 1002 or ASTM C 954, type appropriate to use.

2.1.7 Corner Bead, Casing Bead, and Control Joints

ASTM D 3678, vinyl as recommended by the veneer plaster manufacturer. Provide flanges free of any material that would adversely affect bonding of the plaster.

PART 3 EXECUTION

3.1 STEEL FRAMING

ASTM C 754. Space framing at 400 mm on center maximum. Partitions shall support applied loads without exceeding the permitted deflection.

3.1.1 Partition Framing System

Metal non-load bearing framing and furring system shall be capable of carrying a transverse load of 24 ksm without exceeding either the allowable stress or a deflection of L/240. Provide studs of 0.45 mm minimum thickness for partitions having the same material and the same material thickness on both sides. For partitions using 0.45 mm thick studs, the surfacing material shall cover the full height of the partition on both

sides, or the stud flange shall be otherwise supported to insure rigidity. Provide studs of 0.84 mm minimum thickness for partitions having different materials or different material thickness on the two sides. At partition ends, corners, and intersections, and at jambs of openings, fasten studs to runners with screws.

3.1.2 Blocking

Provide blocking when mounting equipment. Cut metal or wood blocking to fit in between the framing members. Rigidly anchor blocking to the framing members. Under no circumstances will accessories or other wall mounted equipment be anchored directly to the veneer plaster system.

3.2 APPLICATION OF GYPSUM BASE

Apply gypsum base to framing and furring members in accordance with ASTM C 844 and the requirements specified herein. Provide gypsum base of maximum practical length, using full length boards for vertical application. Install separate boards in moderate contact without forcing in place. Install boards tight against the framing so as to eliminate any offset in the face plane between adjoining boards. Stagger end joints of adjoining boards. Fit abutting end and edge joints. Cut boards as required to make close joints around openings.

3.2.1 Control Joints

Control joints in ceilings and walls shall be one piece manufactured products designed for use with a veneer plaster system.

3.3 JOINT REINFORCEMENT

Reinforce all interior angles and flat joints prior to application of the veneer plaster. Do not use self-adhering mesh. Reinforcement shall be a special mesh reinforcing strip embedded in veneer plaster, or gypsum wallboard joint tape embedded in joint compound.

3.3.1 Mesh Reinforcing

Embed the mesh reinforcing strip in veneer plaster, so that embedment material is both under and covering the reinforcement. Allow areas of reinforcement to preset, and leave rough enough for proper bonding of the plaster coat. Reinforcement shall be set but not dry, before the application of veneer plaster.

3.3.2 Paper Tape Reinforcing

Press the paper tape into a bedding coat of setting type joint compound, and immediately cover with a skim coat of the same compound. After the bedding and skim coats are set, apply a fill coat of joint compound. Set the reinforcement and dry thoroughly before application of veneer plaster.

3.4 APPLICATION OF GYPSUM VENEER PLASTER

Apply gypsum veneer plaster in accordance with ASTM C 843, and with the manufacturer's approved installation instructions where such instructions are additional to or more restrictive than the requirements of ASTM C 843. Apply plaster as a one-component system. Minimum plaster thickness shall be as recommended by the manufacturer, but shall in no case be less than 1.6 mm for one-component system.

3.4.1 Mixing

Clean mixer between batches to avoid accelerating the setting time. Do not add other plaster materials to modify the properties of the veneer plaster. When extreme conditions so demand, small quantities of commercial retarder or accelerator may be added to the mixing water to adjust setting time. When used, the retarder or accelerator shall conform to the veneer plaster manufacturer's recommendations.

3.4.2 Application

Trowel plaster on by hand. Apply with sufficient material and pressure to develop bond and to provide the specified component thickness.

3.4.2.1 Finish Coat

Scratch in the finish coat tightly, then immediately double back using material from the same batch. After the plaster has been allowed to set up slightly, lightly trowel the surface without the addition of water, filling all voids and imperfections and eliminating surface irregularities. When the plaster has become firm and prior to set, smooth-trowel the surface using water sparingly. Avoid over troweling.

3.5 CLEANUP AND PATCHING

Remove plaster splashes from adjacent surfaces. Repair defects in the veneer plaster. Plaster surfaces shall be smooth, clean, and in condition to receive the finishing materials that will be applied.

-- End of Section --

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DIVISION 10 - SPECIALTIES

SECTION 10260

CORNER GUARDS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY AND STORAGE
- 1.4 WARRANTY

PART 2 PRODUCTS

- 2.1 GENERAL
 - 2.1.1 Resilient Material
 - 2.1.1.1 Minimum Impact Resistance
 - 2.1.1.2 Fire Rating
 - 2.1.1.3 Integral Color
 - 2.1.1.4 Chemical and Stain Resistance
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- 2.2 CORNER GUARDS
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- 2.3 FINISH
 - 2.3.1 (DELETED)
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PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Corner Guards
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-- End of Section Table of Contents --

SECTION 10260

CORNER GUARDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (DELETED)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM D 256	(2000e1) Determining the IZOD Pendulum Impact Resistance of Plastics
ASTM D 543	(1995; R 2001) Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 635	(1998) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM E 84	(2001) Surface Burning Characteristics of Building Materials
ASTM G 21	(1996) Determining Resistance of Synthetic Polymeric Materials to Fungi
ASTM G 22	(1976; R 1996) Determining Resistance of Plastics to Bacteria

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1545	(1986) Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section

01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Corner Guards

Drawings indicating locations and typical elevations of each type of item. Drawings shall show vertical and horizontal dimensions, full size sections, thickness of materials, and fastening details.

SD-03 Product Data

Corner Guards

Manufacturer's descriptive data, catalog cuts, installation instructions, and recommended cleaning instructions.

SD-04 Samples

Finish; G

Manufacturer's standard samples indicating color and texture of materials requiring color and finish selection.

SD-06 Test Reports

Corner Guards

Fire rating and extinguishing test results for resilient material.

SD-07 Certificates

Corner Guards

Statements attesting that the items comply with specified fire and safety code requirements.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Materials shall be kept dry, protected from weather and damage, and stored under cover. Materials shall be stored at approximately 21 degrees C for at least 48 hours prior to installation.

1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 GENERAL

To the maximum extent possible, corner guards shall be the standard products of a single manufacturer and shall be furnished as detailed. Drawings show general configuration of products required, and items

differing in minor details from those shown will be acceptable.

2.1.1.1 Resilient Material

Resilient material shall consist of high impact resistant extruded acrylic vinyl, polyvinyl chloride, or injection molded thermal plastic and shall conform to the following:

2.1.1.1.1 Minimum Impact Resistance

Minimum impact resistance shall be 960.8 N.m/m when tested in accordance with ASTM D 256, (Izod impact, ft. lbs per sq inch notched).

2.1.1.1.2 Fire Rating

Fire rating shall be Class 1 when tested in accordance with ASTM E 84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less. Material shall be rated self extinguishing when tested in accordance with ASTM D 635. Material shall be labeled and tested by an approved nationally known testing laboratory. Resilient material used for protection on fire rated doors and frames shall be listed by the testing laboratory performing the tests. Resilient material installed on fire rated wood/steel door and frame assemblies shall have been tested on similar type assemblies. Test results of material tested on any other combination of door/frame assembly will not be acceptable.

2.1.1.1.3 Integral Color

Colored components shall have integral color and shall be matched in accordance with SAE J1545 to within plus or minus 1.0 on the CIE-LCH scales.

2.1.1.1.4 Chemical and Stain Resistance

Materials shall be resistant to chemicals and stains reagents in accordance with ASTM D 543.

2.1.1.1.5 Fungal and Bacterial Resistance

Materials shall be resistant to fungi and bacteria in accordance with ASTM G 21 or ASTM G 22, as applicable.

2.2 CORNER GUARDS

2.2.1 Stainless Steel Corner Guards

Stainless steel corner guards shall be fabricated of 1.58 mm thick material conforming to ASTM A 167, Type 316. Corner guards shall be 1200 mm high. Corner guard shall be formed to dimensions shown.

2.3 FINISH

2.3.1 (DELETED)

2.3.2 Stainless Steel Finish

Finish for stainless steel shall be in accordance with ASTM A 167, Type 316, finish number 4.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Corner Guards

Material shall be mounted at location indicated in accordance with manufacturer's recommendations.

3.1.2 Stainless Steel Guards

- a. Mount guards on external corners of interior walls, partitions and columns as per manufacturer's recommendations.
- b. Space brackets at no more than 900 mm on centers and anchor to the wall in accordance with the manufacturer's installation instructions.

-- End of Section --

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DIVISION 10 - SPECIALTIES

SECTION 10520

FIRE EXTINGUISHERS AND CABINETS

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- 1.3 DELIVERY AND STORAGE

PART 2 PRODUCTS

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PART 3 EXECUTION

- 3.1 INSTALLATION

-- End of Section Table of Contents --

SECTION 10520

FIRE EXTINGUISHERS AND CABINETS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1997) Designation System for Aluminum
Finishes

FACTORY MUTUAL ENGINEERING AND RESEARCH CORPORATION (FM)

FM P7825a (2003) Approval Guide Fire Protection

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10 (2002) Portable Fire Extinguishers

UNDERWRITERS' LABORATORIES, INC., (UL)

UL Fire Prot Dir (2004) Fire Protection Equipment Directory

UL 299 (1995) Dry Chemical Fire Extinguishers

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fire Extinguishers

Fire Extinguisher Cabinets

Submit manufacturer's catalog data for fire extinguishers and cabinets.

1.3 DELIVERY AND STORAGE

Materials delivered to the site shall be inspected for damage, unloaded and stored with a minimum of handling. The storage spaces shall be dry locations with adequate ventilation, free from dust or water, and shall permit easy access for inspection and handling.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHER CABINETS

Fire extinguisher trim and door material shall be of extruded aluminum. All cabinets shall have a continuous hinge allowing the door to swing open 180 degrees, full glass door horizontal silk screened red lettering (FIRE EXTINGUISHER) on door, chrome handle, chrome plated latch and stainless steel glass clips. Exposed aluminum surfaces shall be cleaned and given an anodized finish conforming to AA DAF-45. Finish shall be clear (natural) designation AA-M10-C22-A41, Architectural Class I (0.7 mil or thicker). Cabinets shall be surfaced and semi-recessed, sized for fire extinguishers specified. Manufacturer's standard latch and lever door handle for each cabinet in accordance with ADAAG, 4.27.4.

2.2 FIRE EXTINGUISHERS

Multi-purpose dry chemical fire extinguishers, 4.5 kg normal capacity; 80B:C minimum shall be used in the paint spray booth and 4A:60B:C shall be provided in all other locations. Except for paint spray booth extinguishers, the dry chemical fire extinguishers shall be capable of extinguishing Class A, B, and C fires, meeting UL 299, fully approved and listed by Underwriters' Laboratories, Inc., (UL Fire Prot Dir) or Factory Mutual (FM P7825a) into the fire extinguisher cabinets.

PART 3 EXECUTION

3.1 INSTALLATION

Fire extinguisher cabinets shall be installed in accordance with manufacturers' printed instructions and NFPA 10. Top of fire extinguisher cabinets shall not exceed 1350 mm above finish floor level; bottom of fire extinguisher cabinets shall not be less than 675 mm above finish floor level. Cabinets shall be mounted so that extinguisher operating instructions face outward, the location of the extinguisher shall be marked conspicuously.

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- 2.3 SUBMERSIBLE SEWAGE PUMPS
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 - 2.3.2 Impeller
 - 2.3.3 Shaft and Shaft Seals
 - 2.3.4 Bearings
 - 2.3.5 Pump and Motor
- 2.4 PUMP MOTOR
- 2.5 PUMP CONTROL SYSTEM
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 - 2.5.2 (DELETED)
 - 2.5.3 Sewage Pump Alarm and Control Panel
 - 2.5.4 Electrical Requirements
 - 2.5.5 Electric Motor
- 2.6 UNDERGROUND EQUIPMENT ENCLOSURE
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PART 3 EXECUTION

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 - 3.2.1 Jointing
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- 3.6 FIELD TESTS AND INSPECTIONS
 - 3.6.1 Testing Procedure
 - 3.6.2 Sewage Pump Station

-- End of Section Table of Contents --

SECTION 11312

SEWAGE PUMP STATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M198 (1994) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1 (1983; R 2001) Pipe Threads, General Purpose, Inch

ASME/ANSI B16.1 (1989) Cast Iron Pipe Flanges and Flanged Fittings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167 (1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 312/A 312M (2001) Seamless and Welded Austenitic Stainless Steel

ASTM A 536 (1984; R 1999e1) Ductile Iron Castings

ASTM A 934/A 934M (DELETED)

ASTM C 94/C 94M (2000e2) Ready-Mixed Concrete

ASTM C 443 (DELETED)

ASTM C 478 (DELETED)

ASTM D 1784 (1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D 1785 (1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120

ASTM D 2241 (2000) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2002) Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2002) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM E 1745	(1997) Plastic Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1219 mm), for Water
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1999) Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151	(2002) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C214	(1995) Tape Coating Systems for the Exterior of Steel Water Pipelines
AWWA C500	(1993; C500a) Metal-Seated Gate Valves for Water Supply Service
AWWA C509	(1994; Addendum 1995) Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(1999) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA M23	(1980) Manual: PVC Pipe - Design and Installation

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1998) Motors and Generators
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UNI-BELL PLASTIC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3	(1992) Recommended Practice for the
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Installation of Polyvinyl Chloride (PVC)
Pressure Pipe (Nominal Diameters 4-36 Inch)

1.2 DESCRIPTION OF WORK

The work includes providing submersible sewage pump station and related work. Provide system complete and ready for operations. Pump station system including equipment, materials, installation, and workmanship shall be as specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Pipe and fittings

Check valves

Gate valves

Submersible sewage pumps

Pump motor

Flexible flanged coupling

SD-10 Operation and Maintenance Data

Submersible Sewage Pumps

Include pumps, alarms, and motors. Data for submersible sewage pump station data shall include all information on all equipment, alarm panel and controls, pumps and pump performance curves, and station layout.

1.4 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store rubber gaskets not to be installed immediately under cover, out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.4.2 Handling

Handle pipe, fittings, valves, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry pipe to the trench; do not drag it.

1.5 EXCAVATION, TRENCHING, AND BACKFILLING

Provide in accordance with Section 02315A EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS AND PAVEMENTS.

PART 2 PRODUCTS

2.1 PIPING AND FITTINGS

2.1.1 Flanged Pipe

AWWA C151, thickness Class 52.

2.1.2 Fittings

AWWA C110, flanged. Provide flanged joint fittings within wet well and valve vault as indicated. Provide mechanical joint fittings outside valve vault enclosure as indicated. Fittings shall have pressure rating at least equivalent to that of the pipe.

2.1.3 Joints

AWWA C115, flanged joints. Bolts, nuts, and gaskets for flanged connections shall be as recommended in the Appendix to AWWA C115. Flange for sets crewed flanges shall be of ductile iron, ASTM A 536, Grade 65-45-12, and shall conform to the applicable requirements of ASME/ANSI B16.1, Class 250. Setscrews for set screwed flanges shall be 131 MPa tensile strength, heat treated, and zinc coated steel. Gasket for set screwed flanges shall conform to the applicable requirements for mechanical joint gaskets specified in AWWA C111. Design of set screwed gasket shall provide for confinement and compression of gasket when joint to adjoining flange is made.

2.1.4 Polyvinyl Chloride (PVC) Pressure Pipe and Associated Fittings

2.1.4.1 Pressure and Fittings Less than 100 mm Diameter

Pipe, couplings and fittings shall be manufactured of materials conforming to ASTM D 1784, Class 12454-B.

- a. Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D 1785, Schedule 80, with joints meeting requirements of 1.03 MPa working pressure, 1.38 MPa hydrostatic test pressure, unless otherwise shown or specified. Fittings for threaded pipe shall conform to requirements of ASTM D 2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings. Pipe couplings when used, shall be tested as required by ASTM D 2464.
- b. Push-On Joints: ASTM D 3139, with ASTM F 477 gaskets. Fittings for push-on joints shall be iron conforming to AWWA C110 or AWWA C111. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104.
- c. Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 1.03 MPa working pressure and 1.38 MPa hydrostatic test pressure. Fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467.

2.1.5 Insulating Joints

Provide between pipes of dissimilar metals a rubber gasket or other approved type of insulating joint or dielectric coupling which shall effectively prevent metal-to-metal contact between adjacent section of piping.

2.1.6 Accessories

Provide flanges, connecting pieces, transition glands, transition sleeves and other adapters as required.

2.1.7 Flexible Flanged Coupling

Provide flexible flanged coupling applicable for sewage as indicated. The flexible flanged coupling shall be designed for a working pressure of 2.41 MPa.

2.1.8 Service Lateral

A forced sewer main service lateral kit is required for installation of the required pump station. The service lateral kit using Schedule 40 PVC pipe shall be used, see manufactures requirements and installation recommendations for service lateral kit details.

2.2 VALVES AND OTHER WATER MAIN ACCESSORIES

2.2.1 Gate Valves in Valve Vault

AWWA C509. Valves conforming to AWWA C509 shall be outside-screw-and-yoke rising stem type with double-disc gates. Provide valves with hand wheels and shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. Valves shall be of one manufacturer.

2.2.2 Check Valves Less Than 100 mm Diameter

Neoprene ball check valve with integral hydraulic sealing flange, designed for a hydraulic working pressure of 11.21 MPa.

2.2.3 Identification Tags and Plates

Provide valves with tags or plates numbered and stamped for their usage. Plates and tags shall be of brass or nonferrous materials and shall be mounted or attached to the valve.

2.2.4 Pipe Support

The pipe support shall be Schedule 40, Type 316 stainless steel pipe conforming to ASTM A 312/A 312M. Provide Type 316 stainless steel fittings.

2.2.5 Miscellaneous Metals

Bolts, nuts, washers, anchors, and supports necessary for the installation of equipment shall be Type 316 stainless steel.

2.2.6 Quick Disconnect System with Hydraulic Sealing Flange

The quick disconnect system shall consist of a Type 316 stainless steel base plate, ASTM A 167, for supporting the pumps, a hydraulic sealing flange, pump guide rails and the discharge pipe supports. The two guide rails shall be Type 316 stainless steel. A stainless steel lifting chain shall be provided for raising and lowering the pump in the basin. Guides shall be built onto the pump housing to fit the guide post in order to assure perfect alignment between the pump and guide rails.

2.2.7 Wet Well Vent

Type 316 stainless steel pipe conforming to ASTM A 312/A 312M with stainless steel insect screening.

2.3 SUBMERSIBLE SEWAGE PUMPS

Provide submersible grinder pumps as required for the selected pump station. Combined capacity of the pumps shall be 1.1354 lps. The Total Dynamic Head required for the pump station is 11 m.

2.3.1 Casing

Provide hard, close grained cast iron casing which is free from blow holes, porosity, hard spots, shrinkage defects, cracks, and other injurious defects. Design casings to permit replacement of wearing parts. Passageways shall permit the smooth flow of sewage and shall be free from sharp turns and projections.

2.3.2 Impeller

Provide non-clogging type cast iron, or bronze impeller. Make impeller with smooth surfaces, free flowing with the necessary clearance to permit objects in the sewage to pass. Fit and key, spline, or thread impeller on shaft, and lock in such manner that lateral movement will be prevented and reverse rotation will not cause loosening.

2.3.3 Shaft and Shaft Seals

Provide shaft of stainless steel. Provide mechanical seal of double carbon and ceramic construction with mating surfaces lapped to a flatness tolerance of one light band. Hold rotating ceramics in mating position with stationary carbons by a stainless steel spring. Oil lubricated bearings.

2.3.4 Bearings

Provide heavy duty ball thrust bearing or roller type bearing of adequate size to withstand imposed loads. Oil lubricated bearings.

2.3.5 Pump and Motor

The pump and motor shall be assembled on a single stainless steel shaft in a heavy duty cast iron shell. The pump support legs shall be free standing cast iron.

2.4 PUMP MOTOR

Provide submersible sewage pumps in a wet well NEMA MG 1, 1725 RPM, 240

volts, 1 phase, and 60 Hz cycle and for submersible pumps. Motor horsepower shall be not less than pump horsepower at any point on the pump performance curve. Fit motors with lifting "eyes" capable of supporting entire weight of pump and motor.

2.5 PUMP CONTROL SYSTEM

All necessary control shall be located in the top housing of the core unit.

The top housing will be attached with stainless steel fasteners. Non-fouling waste water level detection for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air-bell level sensor connected to a pressure switch. The pumps shall be activated at 450 mm above the wet well floor and shut off at 350 mm. The level detection device shall have no moving parts in direct contact with the waste water. High level alarm sensing will be accomplished in the same manner detailed above by a separate air-bell sensor and pressure switch of the same type. The high level alarm will be activated at 660 mm above the wet well floor.

To assure reliable operation of the pressure sensitive switches, each core unit shall be equipped with a breather assembly, complete with a suitable means to prevent accidental entry of water into the motor compartment.

2.5.1 (DELETED)

2.5.2 (DELETED)

2.5.3 Sewage Pump Alarm and Control Panel

Alarm panel shall be enclosed in a NEMA 4X enclosure and have a flashing red light with long life bulb in guarded enclosure and 150 mm diameter horn. Horn shall emit 120 dB at 3 meter. Alarm horn and light shall be powered from 12 V DC power supply with battery backup. Provide a rechargeable battery rated to power both the horn and light for a minimum of two hours upon loss of main power. Provide circuitry to automatically recharge the battery after main power is restored. Full charge of battery shall take no more than 20 hours. Panel shall have power on light, push to test button for horn and light and push to silence button for horn and light with automatic reset for next alarm. Alarm shall activate under the following conditions:

- a. High liquid level as sensed by float switch.
- b. Loss of main power.
- c. No flow light as sensed by limit switch on the check valve.

2.5.4 Electrical Requirements

Furnish motors with their respective pieces of equipment. Motors, controllers, contactors, and disconnects shall be as specified in Section 16415A ELECTRICAL WORK, INTERIOR. Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Power wiring and conduit for field installed equipment shall be provided.

2.5.5 Electric Motor

The electrical motor shall be hermetically sealed. The power cable shall be sealed inside of the motor and bell. The cable shall be neoprene covered with a flexible metal cover over it for its full length.

2.6 UNDERGROUND EQUIPMENT ENCLOSURE

2.6.1 Access Hatch Cover

Provide aluminum access hatch cover as indicated. The access hatch shall include lifting mechanism, automatic hold open arm, slam lock with handle, and flush lift hand with red vinyl grip. The automatic hold open arm shall lock in the 90 degree position. The cover shall be 6 mm diamond plate with 6 mm channel frame and continuous anchor flange. The access hatch cover shall be capable to withstand a live load of 91 kg/sm. Provide stainless steel cylinder lock with two keys per lock, keyed alike.

2.6.2 Wet Well

Provide a tank made of high density polyethylene, with a melt index of 2.0 grams/10 minutes or lower to assure high environmental stress cracking resistance. The tank shall have a nominal thickness of 13 mm. All seams created during tank construction are to be thermally welded and factory tested for leak tightness. The wet well shall be 953 mm high with a diameter of 986 mm and have a capacity of at least 570 liters.

2.6.2.1 (DELETED)

2.6.2.2 (DELETED)

2.6.3 Wet Well Base Material

Provide crushed rock as indicated and specified in Section 02315A EXCAVATION, FILLING AND BACKFILLING FOR STRUCTURES. Provide vapor retarder conforming to ASTM E 1745, Class B, 0.25 mm thickness, polyolefin geomembrane.

2.6.4 Concrete Anchor

A concrete anchor of 3040 kilograms is required for the installation of the required pump station. The concrete anchor shall be a minimum of 720 mm high with a minimum diameter of 1730 mm. Follow the manufactures requirements and installation recommendations for concrete anchor details.

PART 3 EXECUTION

3.1 INSTALLATION

Provide pump station in accordance with drawings and requirements of the respective equipment manufacturers. Dampen and isolate equipment vibration.

3.2 INSTALLATION OF DUCTILE IRON PRESSURE LINES

Install pipe and fittings in accordance with the general requirements for installation of pipelines and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust

restraint, except as otherwise specified in the other subparagraphs hereunder.

3.2.1 Jointing

Make flanged joints with the gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other accessories. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When any flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions. Use set screwed flanges to make flanged joints where conditions prevent the use of full length flanged pipe and assemble in accordance with recommendations of the set screwed flange manufacturer. Make insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves shall be full size for the bolt holes. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.

3.2.2 Pipe Anchorage

Provide concrete thrust blocks (reaction backing) for pipe anchorage. Thrust blocks shall be in accordance with the requirements of AWWA C600 for thrust restraint, except that size and positioning of thrust blocks as indicated. Use concrete conforming to ASTM C 94/C 94M having a minimum compressive strength of 13 MPa at 28 days, or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having minimum compressive strength of 13 Mpa at 28 days.

3.2.3 Exterior Protection

Completely tape wrap buried water systems, including water main, valves, fittings, and other metal accessories, in accordance with AWWA C214. The tape wrapped system shall include a primer and three layers of tapes; 0.5 mm for inner layer, and two outer layers each of 0.75 mm, total tape wrapped system of 2 mm.

3.3 INSTALLATION OF PVC PLASTIC PRESSURE PIPE AND FITTINGS

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled, "General Requirements for Installation of Pipelines;" with the requirements of UBPPA UNI-B-3 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of valves, and fittings; and with the recommendations of pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

- a. Jointing: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric gasket bell end pipe or elastomeric gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory made bevel; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile iron pipe used for the same type of joint. Use

an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe to pipe joint connections in accordance with the requirements of UBPPA UNI-B-3 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings, valves and other accessories in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression type joints/mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint; assemble in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111. Cut off spigot end of pipe for compression type joint/mechanical joint connections and do not re-bevel. Assemble joints made with sleeve type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression type joints.

- b. Pipe Anchorage: Provide concrete thrust blocks (reaction backing) for anchorage. Thrust blocks shall be in accordance with the requirements of UBPPA UNI-B-3 for reaction of thrust blocking and plugging of dead ends, except that size and positioning of thrust blocks shall be as indicated. Use concrete conforming to ASTM C 94/C 94M having a minimum compressive strength of 20 MPa at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

3.4 INSTALLATION OF VALVES

Install gate valves conforming to AWWA C500 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, Operation, and Maintenance of Gate Valves) to AWWA C500. Install gate valves conforming to AWWA C509 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, Operation, and Maintenance of Gate Valves) to AWWA C509. Install check valves in accordance with the applicable requirements of AWWA C600 for valve and fitting installation. Make and assemble joints to gate valves as previously specified for making and assembling the same type joints between pipe and fittings.

3.5 EQUIPMENT INSTALLATION

Install equipment in accordance with these specifications and the manufacturer's installation instructions. Grout equipment mounted on concrete foundations before installing piping. Install piping to avoid imposing stress on any equipment. Match flanges accurately before securing bolts.

3.6 FIELD TESTS AND INSPECTIONS

Perform all field tests, and provide all labor, equipment, and incidentals required for testing. The Contractor shall produce evidence that any item of work has been constructed in accordance with contract requirements. Allow concrete to cure a minimum of 5 days before testing any section of

piping where concrete thrust blocks have been provided.

3.6.1 Testing Procedure

Test piping in accordance with the Section 02531 SANITARY SEWERS. All equipment shall be tested in operation to demonstrate compliance with the contract requirement.

3.6.2 Sewage Pump Station

Pumps and controls shall be tested, in operation, under design conditions to ensure proper operation of all such equipment. All appliances, materials, water, and equipment for testing shall be provided by the Contractor, and all expenses in connection with the testing shall be borne by the Contractor. Testing shall be conducted after all equipment is properly installed, electrical services and piping are installed, liquid is flowing and the pump station is ready for operation. All defects discovered shall be corrected to the satisfaction of the Contracting Officer, and all tests repeated, at the expense of the Contractor, until the equipment is in proper working order.

-- End of Section --

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SECTION 11502

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SECTION 11502

PAINT/RHINO SPRAY BOOTH

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.95 Occupational Noise Exposure

29 CFR 1910.107 Spray Finishing Using Flammable and Combustible Materials

29 CFR 1910.134 (DELETED)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6 (2001) Enclosures for Industrial Controls Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 33 (2003) Standards for Spray Application Using Using Flammable or Combustible Materials

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES, INC. (UL)

UL 900 (1994; Rev thru Nov 1999) Test Performance of Air Filter Units

1.2 SCOPE OF WORK

Provide a complete paint booth system for prime coating and top coating military vehicles at the U.S. Army Kwajalein Atoll/Kwajalein Missile Range (USAKA/KMR). The military vehicles include pickup trucks, mini-vans, 2-1/2 and 5-ton trucks, Heavy Equipment Transporters (HET), Rough Terrain Container Handlers (RTCH), M105 trailers, 40-Ton cranes, 140-Ton cranes, M872 Trailers, M4K Forklifts, M10A Forklifts, 900 series trucks, M149 Water Buffaloes, and bulldozers.

1.2 DESCRIPTION OF WORK

Provide a pre-engineered corrosion resistant Paint Spray Booth within the vehicle paint and prep building. The principal components of the Paint Spray Booth are the self-standing booth or interior wall mounted 18 gauge, corrosion resistant metal panels Z275 galvanized or equivalent metal panels, the make-up Air Intake System, the Exhaust System, automatic

Roll-up Doors, the Lighting System, Breathing Air Supply Piping System, the Compressed Air (Service) Piping System, and the Electric Controls and Alarms. Breathing air and compressed air supply piping for both systems shall be furnished by the Contractor. The entire Paint Spray Booth facility compressed air-piping system is the responsibility of the Contractor. The work required under this section includes furnishing, installing and testing new equipment. Provide and make utility connections to equipment in accordance with the physical dimensions, capacities and other requirements of the equipment furnished. A factory trained installation supervisor shall be present for installation and start up.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Paint spray booth

Provide elevations showing the arrangement of the breathing air and the compressed air outlet fixtures. Provide details for the breathing air piping regulator and filter installation. Provide an elevation that indicates the lighting fixture installation in relation to the previously mentioned items. Lighting fixtures will be in accordance with NFPA 33, 2000 Edition, Paragraph 4.4. Fire sprinkler system will be the responsibility of the fire protection contractor.

Air intake system

Provide manufacturer's recommended installation procedures. Provide detailed drawings for Make up air unit and air salt pocket filters. Provide detailed drawings for Make up air supply delivery openings.

Exhaust system with 3-stage paint arrestor filter system

Provide manufacturer's recommended installation procedures and drawings. Provide detailed drawings of all necessary reinforcements, bracing, supports, framing, gasketing and fastening. Provide details of exhaust plenum and access openings, the exhaust fan(s), exhaust air 3-stage paint arrestor filter pad and pocket filter system and holding mechanism, exhaust stacks, muffler, automatic roof ventilator and access doors to be used for servicing the exhaust fans.

Electric automatic roll-up metal doors with manual override

Provide manufacturer's recommended installation procedures. Provide explosion proof motor with manual override capabilities. Interior pushbuttons for roll-up doors are to be explosion proof.

Lighting system

Provide manufacturer's recommended installation procedures. Provide details for the lighting fixtures and its supporting hardware. Provide details on interior access frames. Include details on servicing lighting fixtures in the operating and maintenance manual.

Breathing air supply system and piping to paint booth

The booth manufacturer shall provide two Breathing air purifiers. Each Breathing purifier shall be capable of serving two breathable compressed air lines.

Compressed (service) air supply piping to paint booth

Comply with the requirements of paragraph entitled "COMPRESSED AIR SYSTEM" in Section 15400A PLUMBING, GENERAL PURPOSE for specific system details.

Electrical Controls, Alarms & Starter Disconnect

Provide elevations that locate all paint booth control panels and electrical controls.

Two-stage air makeup pocket salt filter and paint booth ceiling air makeup filter system

Electrical Distribution System

Provide a single line diagram of the "as-built" building electrical system and a schematic diagram of electrical control system. Locate all installed electric equipment.

SD-03 Product Data

Manufacturer's standard catalog data, at least 5 weeks prior to the purchase or installation of a particular component, highlighted to show material, size, options, performance charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Data shall include manufacturer's recommended installation instructions and procedures. Data shall be submitted for each of the specified component:

Paint Spray Booth

Air Intake System

Exhaust System with 3-stage Paint arrestor Filter system

Electric Automatic Roll-up Metal Doors with manual override

Lighting System

Breathing Air Supply System, purifiers, carbon monoxide monitor, alarm, filter, and hoses

If the catalogs supplied refer to more than one model or type of equipment, the catalogs should be clearly annotated to show which product is being supplied under this contract.

Spare Parts Data

Spare parts data for each different item of equipment specified, after approval of detail drawings no later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of parts recommended by the manufacturer to be replaced on a routine basis.

Posted Instructions

Posted instructions, at least 4 weeks prior to construction completion, including equipment layout, wiring and control diagrams, piping, and control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventive maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions shall be framed under glass or laminated plastic and posted where indicated by the Contracting Officer.

Verification of Dimensions

A letter at least 4 weeks prior to beginning construction, including the date the site was visited, conformation of existing conditions, and any discrepancies found.

System Performance Test

A schedule, at least 4 weeks prior to the start of related testing, for the system performance tests. The Schedules shall identify the proposed date, time, and location for each test.

Demonstrations

A schedule, at least 4 weeks prior to the date of the proposed training course, which identifies the date, time, and location of the training.

SD-05 Design Data

Paint Spray Booth -Side-Draft Calculations

Provide calculations stamped and signed by a Registered Professional Engineer, for all design data submittals.

SD-06 Test Reports

System Performance Tests

Six copies of each test containing the information described below in bound 216 x 279 mm booklets. The report shall document compliance with the specified performance criteria upon completion of testing of the system. The report shall indicate the number of days covered by the tests and any conclusions as to the adequacy of the system.

a. Paint Spray Booth

- b. Air Intake System
- c. Exhaust System with 3-stage Paint arrestor Filter system
- d. Electric Automatic Roll-up Metal Doors with manual override
- e. Lighting System
- f. Breathing Air Supply System, purifiers, carbon monoxide monitor, alarm, filter, and hoses

SD-07 Certificates

Provide Certificate of Compliance in writing of satisfactory compliance with 29 CFR 1910.107, NFPA 70 and NFPA 33, 2000 Edition regulations with the exception that the designed airflow shall be not less than 0.255 m/sec for sidedraft exhaust systems.

SD-10 Operation and Maintenance Data

Operation Manuals

Six complete copies of operation manual in bound 216 x 279 mm booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown at least 4 weeks prior to the first training course. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.

Maintenance Manuals

Six complete copies of maintenance manual in bound 216 x 279 mm booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include equipment layouts and simplified wiring and control diagrams of the system as installed.

- a. Paint Spray Booth
- b. Air Intake System
- c. Exhaust System with 3-stage Paint arrestor Filter system
- d. Electric Automatic Roll-up Metal Doors with manual override
- e. Lighting System
- f. Breathing Air Supply System, purifiers, carbon monoxide monitor, alarm, filter, and hoses.

Submit operations and maintenance data in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

In addition to the requirements of Section 01781 OPERATION AND MAINTENANCE DATA, submit the manual in a three-ring, hard cover, notebook. Provide index tabs that are specific to the required

subject matter. Submit all drawings, illustrations, schematic and control, exploded views and diagrams as specific in Section 01781 OPERATION AND MAINTENANCE DATA, in 216 mm by 279 mm by 432 mm format.

Submit one complete installation manual: an AutoCAD CD of electrical control system drawings, operating equipment and installation drawings manual to the Contracting Officer for review and approval, a minimum of 30 days prior to the performance of abrasive blast room tests. Seven copies of the approved manuals with all test results included shall be provided to the Contracting Officer after completion of satisfactory system testing.

1.4 LOGISTICS

Should the Contractor or equipment manufacturer or vendor provide special electronic circuits which have been created specifically for the execution of this contract and not for the purpose of uniform model field change of product line modification, then these items shall be identified at their field replacement levels as specialty items in all listings of equipment, components, spare parts or consumables. The Contractor and equipment manufacturer or vendor shall provide to the Government all rights to manufacture, for the Government's own use, specialty items. The manufacturing data, process, drawings, artwork, machine control data, and programming data which are necessary to prepare the specialty item for field installation shall be provided to the Government at the time for equipment acceptance.

1.5 SIGNS

Provide signs as specified in accordance with the requirements of Section 10440 INTERIOR SIGNAGE.

PART 2 PRODUCTS

2.1 PAINT SPRAY BOOTH DESCRIPTION

The Paint Spray Booth consists of an Automatic Metal Roll-Up Doors with Manual Override, Make-up Air Intake System, Exhaust System, Lighting System, Breathing Air Piping System, Compressed Air Piping System, Respiratory Protector, Personal Air Conditioner, Mask, Controls and Alarms, and the Electrical Distribution System. Breathing air and compressed air shall be supplied to the paint spray booth. The supply piping for both systems shall be furnished by the Contractor.

2.2 PAINT SPRAY BOOTH

2.2.1 Materials and Fabrication

The Paint Spray Booth shall be fabricated for a side-draft ventilation system. The interior liner panels of the paint spray room shall be fabricated from 18 gauge 1.25 mm thick, Z275 hot dipped galvanized sheet steel (minimum). Panels shall be stiffened, pre-drilled, and bolted together with gaskets that will prevent leakage. All bolts, anchors, nuts and washers in non-air-conditioned spaces shall be Type 316 stainless steel. The interior surfaces of the spray area shall be smooth and designed to prevent pocketing of residues and to facilitate ventilation, and cleaning. After the booth is erected, the interior of the spray area

enclosure shall be coated with a white, strippable peel coat. A 91.44 meter roll of 1.83 meter wide, removable and replaceable, flame retarding paper floor covering shall be provided. Two personnel doors shall be provided as specified in Section 08115 STAINLESS STEEL DOORS AND FRAMES and as indicated on the drawings. The personnel doors of the paint spray booth enclosure shall be supplied with installed interior aluminum panic type hardware. All required door limit switches and control interlocks are to de-energize the compressed air supply if a roll-up door, or personnel door is opened during painting operation. If switches or powered door pushbuttons are located inside of the spray booth, or the hazardous zone adjacent to the paint booth, the switches and pushbuttons shall be explosion proof.

2.2.2 Capacity and Dimensions

The room size shall be as indicated on the drawings.

2.2.3 Automatic Metal Roll-Up Doors with Manual Override

2.2.3.1 Materials and Fabrication

The doors shall be of the 1-hour fire rated. The structural elements of the door assembly shall be fabricated from 1.25 mm galvanized steel. The doors shall provide a dust tight seal. The doors shall be provided with a sensor to detect the door in a closed positions.

2.2.4 Make-up Air Intake System

2.2.4.1 Materials and Fabrication

The air intake system consists of in-line centrifugal fans, stainless steel supply air duct, salt filters, factory supplied air intake filters, differential pressure gauge and pressure switch.

2.2.4.2 Supply Air Fans and Salt Filters

Provide supply air fans and salt filters as indicated on the drawings and in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

2.2.4.3 Booth Manufacturer Supplied Air Intake Filters

Air Intake filters shall not support combustion and shall have a UL 900 Class 1 rating. Make-up air filters shall not interfere with the efficiency of exhaust fan operation and shall minimize creation of dead air pockets. Back-draft dampers shall open when the paint room exhaust fans are running. The paint spray booth ceiling make-up air filters shall be replaceable from the interior of the paint booth. The filter media shall be dry type, replaceable polyester pad filters with rings. The make-up air filters shall be fabricated from polyester fabric that is treated to provide a dust trapping capability. Replacement filters shall be standard catalog items that are manufactured and sold as make-up air intake filters, and are readily available from sources. Provide a differential pressure gauge and pressure switch for booth supplied air intake filters and salt filters. The gauge shall be graduated to show pressure drop to indicate when air filters needs to be replaced.

2.2.5 Exhaust System

2.2.5.1 Materials and Fabrication

The Exhaust System consists of side-draft exhaust plenum, paint arrestor filter set, exhaust fan(s), muffler, exhaust stacks (316 SS), automatic roof stack head ventilator cap and the metal maintenance platform and access ladder.

2.2.5.2 Side-Draft Plenum

The exhaust plenum shall be constructed of 1.25-mm (minimum) Z275 hot-dipped galvanized steel with panels. All distribution of baffle plates, if any, shall be made of non-combustible material and shall be readily removable or accessible on both sides for cleaning. The exhaust plenum shall be provided with draft pressure drop gauges to show when paint arrestor exhaust filters need replacing. The paint spray area shall be equipped with an audio/visual alarm that activates and warns the system operators when airflow through the paint arrestor filter system has become restricted beyond the manufacturer's recommended level. When the paint arrestor filter alarm is activated, an electric interlock shall prevent further application of paint until the filters have been replaced. The operating and maintenance manual shall set these operating levels, and explain filter replacement criteria and procedures.

Installation shall include all necessary reinforcements, bracing, supports, framing, gasketing and fastening to guarantee rigid construction and freedom from vibration, airflow induced motion, and excessive deflection. The exhaust plenum shall be designed to support the exhaust fan assembly, a maintenance platform, an access ladder, and the weight of necessary maintenance personnel. The installation and use of these items must not interfere with the airtight integrity of the exhaust plenum's rear wall. The ladder shall be designed to accommodate a load of 140 Kg. Duct supports shall be designed to carry the weight of the duct system itself plus the anticipated weight of any conveyed materials. Since sprinkler protection shall be provided inside the duct system, the duct support shall also be designed to carry the anticipated weight of any accumulation of sprinkler discharge. Laps in duct construction shall be in the direction of airflow. Access doors shall be provided in horizontal ducts adjacent to elbows, junctions, and vertical ducts. Doors shall be located on the tops or sides of the ducts, and door spacing shall not exceed 3.6 m.

2.2.5.3 Paint Arrestor Filter Set

The paint arrestor filter set proposed shall be coordinated with the design of the exhaust plenum. Manufacturer shall implement NESHAP filters and provide access doors for filter replacement. The exhaust filter media shall not support combustion. Supports and holders for paint arrestor filters shall be non-combustible. Paint arrestor filter system shall have minimum 96.0 percent efficiency and a minimum final resistance of 0.0125 kPa. Paint arrestor filter pads shall be a minimum 500 mm by 500 mm by 50 mm thick. Replacement filters shall be standard catalog items that are manufactured and sold as paint arrestor filters.

Provide a differential pressure gauge and pressure switch. The gauge shall be marked to show pressure drop when air filters need to be replaced.

Space within the spray booth on the downstream and upstream sides of filters shall be protected with approved automatic sprinklers.

Provide one year supply of filter replacement parts.

2.2.5.4 Exhaust Fans

The exhaust fan(s) shall be explosion proof, electric powered, variable pitch motor pulley and shall provide downward air flow velocity across the entire area of the Paint Spray room of not less than 0.255 meter per second. Each of the fan rotating elements shall have four blades of aluminum. There shall be ample clearance between the fan rotating element and the fan casing to avoid a fire by friction. The clearance shall compensate for thermal expansion and fan service loads. Fan blades, hub, and shaft shall be of sufficient strength to allow the rotating elements to remain properly aligned when they are heavily loaded. All exhaust fan motor bearings shall be of the permanently lubricated, heavy duty, ball bearing type; carefully matched to the fan load. Flanges shall be provided at exhaust fan and enclosure connections for ease of access for maintenance and disassembly. Access to the exhaust fan assemblies shall be provided. Provide clean-out access doors in the section of stack that is installed on the outlet side of the exhaust fan(s). The clean-out access doors shall be weather proof, hinged, gasketed, and fitted with snap-action closures.

Clean-out access door gaskets shall be common weather-stripping type, foamed, closed-cell, elastomer with pressure sensitive adhesive back.

2.2.5.5 Exhaust Stacks

The exhaust stack(s) shall be fabricated from stainless steel. Ductwork connecting the paint booth to the stack head exhaust cap (exposed to exterior atmosphere) will be Type 316 stainless steel; and stack height of paint booth exhaust must be a minimum of 1.3 times the building height to ensure the exhaust is not introduced back into the building. Low carbon grade Type 316 stainless steel shall be used in welding applications. The exhaust stacks shall be outfitted with an automatic stack head roof ventilator to prevent rain and foreign objects from entering the system when the booth is not operating. Exhaust stacks shall be extended to 13 meters above grade.

2.2.6 Lighting System

2.2.6.1 Materials and Fabrication

Provide and install enclosed fluorescent light fixtures, each with four 1219 mm OSRAM Sylvania F40/DSGN50, Design 50 fluorescent bulbs, with a color rendering index (CRI) of 90. The fixtures shall be 1-piece die formed 1.25 mm welded steel construction finished with corrosion resistant white enamel. The fixtures shall be the inside access type with a hinged door welded to the fixture housing. The door shall provide access to the lamps and ballast. The fixtures shall provide all necessary mounting and installation hardware, and two end wire connectors for through feed wiring. Lighting fixtures and associated components shall be in compliance with NFPA 33 for operation in a Class I, Division 2 location. Provide additional replacements lamps for a minimum of one year.

2.2.6.2 Capacity and Dimensions

Provide a minimum of 1000 Lux of illumination when measured 914 mm above the finished floor in the center of the paint spray booth.

2.2.7 Control System

2.2.7.1 Material and Fabrication

The Paint Spray Building shall include a complete electric system with appropriate controllers. Enclosures for controls shall conform to NEMA ICS 6 and Division 16 Sections of these Specifications. Electrical wiring and equipment not subject to deposits of combustible residues but located in a spraying area as herein defined shall be of explosion-proof type approved for Class I, Group D locations and shall otherwise conform to the provisions of subpart S for Class I, Division 1, Hazardous Locations. Electrical wiring, motors, and other equipment outside of but within 6.15 meters of any spraying area, and not separated therefrom by partitions, shall not produce sparks under normal operating conditions and shall otherwise conform to the provisions of subpart S of this part for Class I, Division 2 hazardous locations. All metal parts of spray booths, exhaust ducts, and piping systems conveying flammable or combustible liquids or aerated solids shall be properly electrically grounded in an effective and permanent manner. Enclosures for control panels, lighting and controls for the exhaust vent motor shall be installed as indicated on the drawings. All enclosures shall be watertight and weatherproof. Motor controls shall be provided with a "power on" indicating light. Operating instructions shall be provided on laminated acrylic plastic plaques. The plaques shall be a minimum of 216 mm wide by 279 mm long by 3.17 mm thick with a matte finish. The necessary graphics and lettering shall be applied to the rear surface of white plastic sheet by silk screening prior to applying the clear cover laminate. Typeface shall be Helvetica medium, 14 point font, and of black color. The plaques shall be encased in aluminum frames and mounted near the equipment's control panel with appropriate screw fasteners.

2.2.7.2 Capacity and Dimensions

The control panel(s) shall be labeled to indicate function, use, and sequence of operation. The room exhaust fan shall operate on 460 volt ac, 60 Hz, 3 phase, and the lighting shall operate on 277 volt ac, 60Hz, 1 phase power source.

2.2.8 Controls and Alarms

2.2.8.1 Materials and Fabrication

Provide an electrically controlled solenoid valve that will interrupt the air supply system to the spray gun when the exhaust ventilation system is not operating or when the clogged filter alarm is activated. Provide an audio/visual alarm for clogged exhaust filters. All metal parts of the spray area enclosure and the exhaust ducts shall be electrically grounded. Fire sprinklers shall be provided in the paint spray area enclosure and exhaust assembly as required by NFPA 33. Alarm shall be suitable for use in a Class 1, Division I, location in accordance with NFPA 70.

2.3 (DELETED)

2.4 PERSONAL AIR CONDITIONER

Provide two vests with vortex tube for consistent and continuous cooling. The vest shall allow full range of motion with no airflow restrictions and can be worn under welding leathers or protective clothing. The vortex tube

shall be worn on a supplied belt, cool inlet temperature by 15.6 degree C, 225 kCal/hr, 425 SLPM capacity.

2.5 PERSONAL MASK

Provide two full masks with continuous flow of supplied air respirator made of silicone rubber, double sealing flange, polycarbonate lens, and removable hairnet. The personal mask shall be NIOSH approved.

2.6 HYDRAULIC LIFT

Contractor to provide 22,680 kg capacity hydraulic lift system with 5.6 kw motor, 460/3/60. Hydraulic lift shall be installed as shown on the drawings in the Undercoat Room. Overall length of approximately 10.97 meter, width of 4.42 meter, lifting height of 1.52 meters, and weight of 7,711 kg. The distance between posts are 3.66 meters with a track width of 0.610 meter. The lifting mechanism are four direct drive cylinders using no cables, chains or mechanical lifting screws. A mechanical safety system with infinite position mechanical locking wedge shall be provided in each post. A hydraulic safety system with integral hydrostatic line blow off flow control devices and velocity fuses. Provide NEMA Type 4 Waterproof enclosure for push button electronic controls, solenoid operated. Equipment must be structurally and safety tested and certified to ANSI, ALI/ETL ALCTV 1998 automotive lift standard.

2.6.1 Lifting Column

Each column will be constructed of 20 mm "R-34" forklift channel and be rigidly supported and joined together using 3-point fillet welds. The base of each column will be made of 20 mm galvanized steel plate min 610 mm x 610 mm.

2.6.2 Carriage Assembly

Each column will have a carriage constructed of 12 mm galvanized steel plate joined to a 9.5 mm backing plate by 3-point fillet welds, minimum. The carriage assembly will roll up and down smoothly in the forklift mast columns on four 100 mm double sealed self lubricating steel ball bearing rollers.

2.6.3 Cross Rails

The cross rails will be constructed of 203.2 x 254 x 9.5 mm thick galvanized structural tubing.

2.6.4 Tracks

Each track will be constructed of three 304.8 x 203.2 mm structural I-beams welded together by 3-point fillet welds. The surface of the track will be covered by skid resistant diamond plate welded to the top of the I-beam by a continuous fillet weld. An approach ramp will have an 8 degree approach angle.

2.6.5 Control Console

The control console will be a free standing unit with operating controls at 1016 mm working height. The control console shall house the power unit, oil reservoir, suction strainer, low pressure return filter with bypass, hydraulic gear pump submerged in reservoir, electric motor, hydraulic

valving, motor starter, over loads, and NEMA 4 enclosure for electrical terminal strips.

2.6.6 HYDRAULICS

The lift shall incorporate a leveler control system capable of synchronizing track elevations during both raising and lowering operations. The oil reservoir shall be 113 liters capacity. All hydraulic hoses shall be of steel reinforced construction, with a burst rating of 93,079 kPa minimum and have standard JIC fittings throughout. Hydraulic tubing to consist of seamless stainless steel with a minimum outside diameter of 9.5 mm. The lift shall be driven by a hydraulic gear pump, capable of supplying the appropriate pressure and flow to operate the lift. Screw-on disposable type oil filter, with a 10 micron filtering surface shall be located in the return flow oil port in the reservoir.

PART 3 EXECUTION

3.1 INSTALLATION

The components of the paint spray building shall be installed as specified herein.

3.2 VERIFICATION OF DIMENSIONS

Contractor shall be responsible for coordination and proper relation of all work to the building structure and the work of all trades. Verify all dimensions that relate to the fabrication of the Spray Paint Building.

3.3 FIELD INSPECTIONS AND TESTS

Schedule and administer operational tests and inspections. Furnish personnel, instruments and apparatus to perform tests and inspections. Correct defects and repeat the respective inspections and tests. Give the Contracting Officer ample notice of the dates and times scheduled for tests and trial operation. Give at least 5 days prior notice for the respective tests and inspections.

3.3.1 Pre-Installation Inspection

Before installation, inspect all components of the Spray Paint Booth to determine compliance with specification and manufacturer's data and shop drawings as approved.

3.3.2 Operational Tests and Inspections

Upon completion and before final acceptance, operate the Spray Paint Booth system. During operation, inspect and test the system to determine that each component of the system operates as specified is properly installed and adjusted, is free from defects in material, test and make final adjustment of the equipment in accordance with this specification and the manufacturer's specifications. Ensure that Contracting Officer approved operating instructions are posted prior to starting system tests.

3.3.2.1 Training

Provide operation and maintenance training for user maintenance personnel. Provide overview of troubleshooting procedures for all pieces of equipment in the paint booth.

3.3.3 Additional Tests

3.3.3.1 Sound Level

Conduct sound level readings outside Paint Spray Booth, 3.05 meters from the center of the exhaust fan, during operational in-service tests. Sound level not to exceed 84 dBA on Scale 'A' of a standard sound level meter at slow response. Conform to the requirements of 29 CFR 1910.95. If the sound level readings are recorded in excess of those specified, the Contractor shall install sound attenuators to reduce level of sound and the system re-tested. This procedure shall be repeated until specified sound level is obtained at no additional cost to the Government.

3.3.3.2 Safety Shut-Down of Air Supply

A demonstration shall be conducted to prove that the compressed air supply to all spray guns will automatically shut down when the exhaust fan is de-energized, a filter is clogged, a door is opened, or a lighting fixture is open.

3.3.3.3 Adjustments

Adjust the V-belts on the exhaust fan drive pulleys according to manufacturer's specifications.

3.4 SYSTEM PERFORMANCE TESTS

Before the paint/rhino booth is accepted, test to demonstrate the general operating characteristics of all equipment shall be conducted a manufacturer's representative experienced in system start-up and testing, at such times as directed. Tests shall cover a period of not less than 48 hours and shall demonstrate that the entire system is functioning in accordance with the drawings and specifications. Corrections and adjustments shall be made as necessary and tests shall be re-conducted to demonstrate that the entire system is functioning as specified. If tests do not demonstrate satisfactory system performance, deficiencies shall be corrected and the system shall be retested. Tests shall be conducted in the presence of the Contracting Officer. Any material, equipment, instruments, and personnel required for this test shall be provided by the Contractor.

3.5 DEMONSTRATIONS

Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and start after the system is functionally completed but prior to final acceptance tests. The field posted instruction shall cover all of the items contained in the approved operation and maintenance manuals as well as demonstrations of routine maintenance operations.

-- End of Section --

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SECTION 11503

ABRASIVE BLAST BOOTH

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 201 (1990) Fan Application Manual - Fans and Systems

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z9.4 (1997) Ventilation and Safe Practices of Abrasive Blast Operations

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 91 (1999) Standards for Blower and Exhaust Systems for Vapor Removal

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1910.27 Fixed Ladders

29 CFR 1910.94 Ventilation

29 CFR 1910.134 Respiratory Protection

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH-2093 (2001) Industrial Ventilation, Manual of Recommended Practice

1.2 DESCRIPTION OF WORK

Provide a complete turnkey Abrasive Blast System (ABS). The principal components of the system are the Abrasive Blast Room, Dust Collector, Recovery System, Abrasive Reclaim Machine, Blast Machine, CO Monitor, Operator Safety Gear, Compressed Air System, and Breathing Air System. The work required under this section includes furnishing, installing, and testing new equipment. Provide and make utility connections to equipment in accordance with requirements specified in other sections of this specification and in accordance with the physical dimensions, capacities and other requirements of the equipment furnished. A factory trained installation supervisor shall be present for installation and start up.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Abrasive Blast Room

Submit within 60 days of receipt of contract or notice to proceed, a minimum 1:100-mm scale layout drawings of the abrasive blast equipment room. Indicate the detailed arrangement of all Contractor supplied equipment, in their exact locations. Include elevations of the abrasive blast equipment room, to establish that the equipment will fit the allotted spaces with clearance for installation, operation, and maintenance. Provide details of the air intake and exhaust system of the abrasive blast and the abrasive blast equipment rooms. Provide elevations and details of the abrasive blast rooms product and man doors.

Recovery System

Equipment Room

Dust Collector

Submit within 60 days of receipt of contract or notice to proceed, a minimum 1:100 scale layout drawings of the dust collection system. Indicate the detailed arrangement of all Contractor supplied equipment, in their exact locations. Include elevations of the dust collector, to establish that access to its trash bins is easily obtained with a standard 1814 Kg capacity forklift truck.

Salt Filter Air Makeup System and Ductwork

Air Intake System

Provide manufacturer's recommended installation procedures. Provide detailed drawings for Make up air unit and air salt pocket filters. Provide detailed drawings for Make up air supply delivery openings

SD-03 Product Data

Manufacturer's standard catalog data, at least 5 weeks prior to the purchase or installation of a particular component, highlighted to show material, size, options, performance charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Data shall include manufacturer's recommended installation instructions and procedures. Data shall be submitted for each of the specified component:

Dust Collector

Recovery System

Abrasive Reclaim Machine

Blast Machine

Operator Safety Gear

Storage Hopper

If the catalogs supplied refer to more than one model or type of equipment, the catalogs should be clearly annotated to show which product is being supplied under this contract.

Spare Parts Data

Spare parts data for each different item of equipment specified, after approval of detail drawings no later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of parts recommended by the manufacturer to be replaced on a routine basis.

Posted Instructions

Posted instructions, at least 4 weeks prior to construction completion, including equipment layout, wiring and control diagrams, piping, and control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventive maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions shall be framed under glass or laminated plastic and posted where indicated by the Contracting Officer.

Verification of Dimensions

A letter at least 4 weeks prior to beginning construction, including the date the site was visited, conformation of existing conditions, and any discrepancies found.

System Performance Test

A schedule, at least 4 weeks prior to the start of related testing, for the system performance tests. The Schedules shall identify the proposed date, time, and location for each test.

Demonstrations

A schedule, at least 4 weeks prior to the date of the proposed training course, which identifies the date, time, and location of the training.

SD-05 Design Data

Dust Collector

Submit cross draft calculations

Grit recovery system

Submit calculations for balancing blast media recovery system.

Abrasive reclaim machine

Submit calculations for balancing the flow rate of the abrasive reclaim machine.

Blast machine

Submit calculations for balancing the abrasive reclaim machine recovery rate with the blast machine.

Abrasive Calculations

Calculations for maximum amount of abrasive that the entire system may contain during normal blasting operation

SD-06 Test Reports

System Performance Tests

Six copies of each test containing the information described below in bound 216 x 279 mm booklets. The report shall document compliance with the specified performance criteria upon completion of testing of the system. The report shall indicate the number of days covered by the tests and any conclusions as to the adequacy of the system.

- a. Abrasive Blast Room
- b. Dust Collector
- c. Screw media recovery system
- d. Abrasive Reclaim Machine
- e. Blast Machine
- f. Operator Safety Gear
- g. Storage Hopper

SD-07 Certificates

Abrasive Blast System

Provide a certificate of compliance with ANSI Z9.4 and 29 CFR 1910.

SD-10 Operation and Maintenance Data

Operation Manuals

Six complete copies of operation manual in bound 216 x 279 mm booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and

normal shutdown at least 4 weeks prior to the first training course. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.

Maintenance Manuals

Six complete copies of maintenance manual in bound 216 x 279 mm booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include equipment layouts and simplified wiring and control diagrams of the system as installed.

- a. Dust Collector
- b. Recovery System
- c. Abrasive Reclaim Machine
- d. Blast Machine
- e. Abrasive Blast Room Product Doors
- f. Abrasive Blast Booth
- g. Breathing Air Supply System, purifiers, carbon monoxide monitor, alarm, filter, and hoses.

Submit operations and maintenance data in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

In addition to the requirements of Section 01781 OPERATION AND MAINTENANCE DATA, submit the manual in a three-ring, hard cover, notebook. Provide index tabs that are specific to the required subject matter. Submit all drawings, illustrations, schematic and control, exploded views and diagrams as specific in Section 01781, OPERATION AND MAINTENANCE DATA in 216 mm by 279 mm by 432 mm format.

Submit one complete installation manual: an AutoCAD CD of electrical control system drawings, operating equipment and installation drawings manual to the Contracting Officer for review and approval, a minimum of 30 days prior to the performance of abrasive blast room tests. Seven copies of the approved manuals with all test results included shall be provided to the Contracting Officer after completion of satisfactory system testing.

1.4 LOGISTICS

Should the Contractor or equipment manufacturer or vendor provide special parts of components which have been created specifically for the execution of this contract and not for the purpose of uniform model field change or product line modifications, then these items shall be identified at their field replacement level as specialty items in all listings of equipment, components, spare parts or consumables.

1.5 DELIVERY, STORAGE, AND HANDLING

Inspect each piece of equipment upon delivery. Obtain and follow equipment manufacturer's recommendations to protect materials and equipment and prevent damage.

1.6 SIGNS

Provide signs as required by Section 10440 INTERIOR SIGNAGE.

PART 2 PRODUCTS

2.1 ABRASIVE BLAST SYSTEM (ABS) DESCRIPTION

- a. The ABS will house all blasting equipment necessary to provide an abrasive cleaning system using stainless steel grit media (SAE 330). The system will produce a clean product ready for preservation and/or painting. The ABS will include a pre-engineered blasting booth to accommodate the varied size workload required. Storage/recovery of the stainless steel grit media will be provided. The recovery system shall be serviced by a recovery system that transports the used abrasive media and fines from the blast room to the abrasive media reclaim separator. Provide a ventilation system for dust removal and collection. The dust collecting equipment shall be mounted on a concrete foundation outside the building. Provide a personnel two breathing air systems for two operator. The breathing air and electrical systems will be installed in an equipment room separate from the Abrasive Blast Room and the Blast Equipment Room. The ABS shall include a complete electric system including appropriate controllers. Necessary electrical connections for the controllers are specified in Section 16415A ELECTRICAL WORK, INTERIOR. All components of the ABS shall be compatible to meet the requirements of abrasive recovery, ventilation and dust collection and abrasive cleaning without causing overload, excessive down time for maintenance, or blast material short supply in the system. Exhaust ventilation shall be as specified in Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS.
- b. Perform all work and testing required for the installation of the facility and all associated equipment.

2.2 ABRASIVE BLAST SYSTEM FABRICATION AND CONSTRUCTION

These requirements define the minimum design parameters for the ABS.

2.2.1 Maintainability

- a. All components that might be subject to failure shall be positioned for ease of accessibility for replacement. Such items shall be standard items from the manufacturer's catalog. The equipment shall be designed for maintenance by Government maintenance personnel.
- b. The Government shall specify which parts require periodic maintenance, overhaul, and replacement. A list of spare parts, including current prices shall be provided by the Contractor and shall be included in the operation and maintenance manuals.

- c. If special tools are required for maintenance, Contractor shall furnish two sets in lockable metal containers.

2.2.2 Interchangeability

Interchangeability between components of the equipment identical in size and function shall be maximized. Parts and assemblies shall be manufactured to standards that permit replacement or adjustment without modification.

2.2.3 Dust

All bearings, mechanical drive equipment, motors and electrical control equipment shall be enclosed and/or sealed to prevent entry of dust since the equipment will be located in close proximity to the blasting area.

2.2.4 Safety

The design of the equipment shall incorporate sufficient safety devices and features in accordance with 29 CFR 1910, with emphasis on Sections 94, 132, 133, 134, 135, 136, 212 and 219 to ensure protection of personnel, equipment, and maintenance of the equipment. The equipment shall not present safety hazards when subjected to side load forces that may occur. Cut-off switches for rotating parts shall be placed throughout the equipment to manually cut off equipment power to specific sections where continued operation of the equipment might result in damage to equipment or material or cause hazards to personnel.

2.2.4.1 Guards and Screens

Metal personnel safety guards shall be provided for normally accessible unducted fan inlets and discharges and moving power transmission components.

2.2.4.2 Mechanical Safety

- a. Equipment operation shall continue to function when any piping or tubing system is subjected to twice the maximum nominal working pressure.
- b. Pressure vessels, valves, and fittings shall withstand proof pressures.

2.2.5 Electrical

The equipment shall use power from a 115 volt 60 Hertz single-phase source, and 460 volt, 60 Hertz, three-phase source. Sections 16415A ELECTRICAL WORK, INTERIOR.

2.2.6 Controls and Alarms

Controls and alarms shall be located for convenient use and observation by the operator. Each control, indicator, and instrument shall be clearly and legibly marked for function and identification.

2.2.6.1 Power on Signal

A flashing red warning light shall be mounted over each access to the Abrasive Blast Room and shall automatically be activated when the ABS is in operation. A sign forbidding access except in an emergency while the red

light is on shall be mounted in the vicinity of the warning light. The warning light and sign shall be visible from a distance of 15.24 meters (minimum).

2.2.6.2 Operator Signal

During Abrasive Blast System operation inside the abrasive blast room, the operator shall be alerted to interrupt operations by a flashing red light and horn activated by push buttons mounted on outside east wall near each personnel access door. Place alarms as indicated.

2.2.7 Painting

Materials and color shall be the manufacturer's standard. All major equipment shall be cleaned, primed and painted, in shop, prior to shipment. All structural steel in non-air-conditioned spaces shall be primed and painted as specified in Section 09900 PAINTS AND COATINGS. All bolts, anchors, nuts and washers in non-air-conditioned spaces shall be 316 stainless steel. Following installation, all external metal surfaces of equipment and piping other than moving parts, instrument panels or label plates, which are unpainted, prime painted or damaged shall be cleaned, primer painted as necessary and field painted in accordance with Section 09900 PAINTS AND COATINGS.

2.2.8 Mechanical Devices

2.2.8.1 Lubrication

Adequate accessible and positive lubrication shall be provided to all bearings and working surfaces. Wherever necessary, means shall be provided for checking the level of lubricant in all parts and components.

2.2.8.2 Fastening Devices

All screws, pins, bolts and similar parts shall be installed with a means that prevents loss of tightness, or dislodgment. All such parts, if subject to removal or adjustment (maintenance) shall not be swaged, peened, stacked, or otherwise permanently deformed. All bolts, anchors, nuts and washers in non-air-conditioned spaces shall be Type 316 stainless steel.

2.2.8.3 Support Bearings for Blocks and Bearings

Rotating parts shall be mounted with dust tight, sealed, life lubricated anti-friction bearings. Bearing load capacity, including applicable safety and lift factors as recommended by the bearing manufacturer, shall be equal to or greater than maximum bearing loading under all operating conditions specified herein.

2.2.8.4 Chain-driven Mechanisms

Chain-driven mechanisms shall be equipped with chain idler tensioners and safety guards.

2.2.8.5 Gauges and Meters

Gauges and meters shall be English for units of measure and increments. Dual scale dials or indicator shall be used. Gauges and meters shall be easily removable for maintenance and provisions shall be made for in-place calibration.

2.2.8.6 Equipment Access

Sufficient space shall be provided so that all equipment is accessible for operation and maintenance. Components shall be accessible for repair or replacement without necessitating the removal of any major equipment or components.

2.2.9 Transportability

Lifting eyes, handles, or other devices shall be provided on the equipment as necessary to permit safe movement of equipment for relocation and maintenance without exposing the equipment to damage, deformation or misalignment.

2.2.10 Color Coding

Controls, moving parts, and piping shall be color coded in accordance with 29 CFR 1910 paragraph 144.

2.3 ABRASIVE BLAST BOOTH MATERIALS AND FABRICATION

2.3.1 Ceiling

The Abrasive Blast Booth ceiling panels shall be made of 11 gauge (English equivalent) mm steel (minimum). Panels shall be stiffened as indicated, pre-drilled, and bolted together with gaskets to prevent leakage. All bolts, anchors, nuts and washers in non-air-conditioned spaces shall be 316 stainless steel. Panel design shall exclude horizontal ledge or cavities and shall minimize vertical ribbing on the interior of the room. The design for all panels shall be standard for ease of replacement. The arrangement of the panels shall maximize the use of one common size. The design of the ceiling panels shall provide openings for light fixtures to be installed.

2.3.2 Lighting

Provide a minimum of 1,000 Lux of illumination when measured 914 mm above the finished floor in the center of the blast room. Fluorescent type lamps shall be used and shall be installed in the Abrasive Blast Room ceiling and side walls. They shall illuminate the blast room through sealed windows of polycarbonate window pane of a minimum thickness of 6 mm or wire reinforced safety glass. The fixtures shall be designed as removable, from inside the Abrasive Blast Room, for the purpose of lamp maintenance and installation. Lighting shall conform to Section 16415A ELECTRICAL WORK, INTERIOR.

2.3.3 Interior Painting

The interior walls and ceiling of the blast room shall be painted high gloss white enamel above the 3.96 meters level. The remainder of the wall shall be painted with a gray primer. All structural steel in non-air-conditioned spaces shall be primed and painted as specified in Section 09900 PAINTS AND COATINGS. Painting shall be performed prior to installation of light fixtures and air plenums.

2.3.4 Man Access Doors

Provide doors for operator access as indicated on the drawings. Doors shall be equipped with panic hardware and a safety interlock to inhibit

blasting if it is not secured.

2.3.5 Electric Roll-Up Doors

Electric Roll-Up Doors shall be installed as indicated. The doors shall be provided with explosion proof motor and manual pulley capabilities.

2.3.6 Floor Grating

Bar grating shall cover the media recovery pit. Bar grating shall be removable. Open ends of grating shall be banded. Material shall be supplied with Type 316 stainless steel. Bar grating shall be of a common size and shall be designed for easy replacement. Bar grating shall be designed to support the greater of 4,000 Kg wheel loads (impact included) or 2,000 Kg/m² live loading that result from product placement. The support and retention of the bar grating shall be of a design that is consistent with the requirements of the manufacturer of the Grit Recovery System.

2.3.7 Floor

The blast room shall be installed on a hardened concrete floor rated at 27.5 MPa. The blast room floor shall be provided with 316 stainless steel checkered plate secured to the concrete.

2.3.8 Abrasive Blast Booth, Capacity and Dimensions

The blast room shall be sized as indicated on the drawings.

2.3.9 Abrasive Blast Booth, Accessories

One complete operator safety outfit that complies with ANSI Z9.4, 29 CFR 1910.94, and 29 CFR 1910.134 shall be provided. Outfits shall be provided with blast hood respirator, air filter, air conditioner, gloves, pants, jacket, and CO Monitor. Operator safety outfit shall be approved by NIOSH.

- a. Respirator: Blast hood with self-adjusting headband, inner cape, and uniform air distribution. One piece mold with nylon cape, 14" x 5" replaceable plastic window. The hood shall meet NIOSH.
- b. **(DELETED)**
- c. **(DELETED)**
- d. Air Conditioner: Air conditioner shall be attached to the operator's belt and cool air coming into the hood.
- e. Jacket and Pants: jacket and pants shall be heavy duty canvas. Gloves shall be heavy duty leather.

2.4 DUST COLLECTION SYSTEM

Fan arrangements should be selected to eliminate system effects identified in AMCA 201. Ventilation and dust collection equipment shall prevent dust escaping from the enclosure and provide visibility within the booth to the levels established by 29 CFR 1910.94. The system shall be designed and arranged to provide a negative pressure in the room and prevent dust escaping from the room. A belt driven exhaustor, Class III fan equipped, with a silencer that achieves a sound level that does not exceed 84 dBA on

scale A of a standard sound level meter at slow response setting, 3 meters, from the center of the fans exhaust, shall be installed. The fan shall be of sufficient capacity to provide air velocity of at least 1.53 meters per second at the louvered air inlet openings and 0.51 meters per second of cross draft ventilation. Unit shall contain a combined total filter area of at least 2,265 square meters, with an air-to-media ratio not to exceed 2.0:1. Filter housing shall be constructed of 4.55 mm, 3.42 mm and 2.66 mm carbon steel with bolted and welded constructed (riveted construction will not be permitted). Unit shall utilize a factory-supplied abrasion-resistant inlet to minimize the effects of abrasive particulate in the air stream. Dirty air inlet must be on the top-side of the cartridge housing, creating a downward airflow direction inside the unit. Do not locate the dirty air inlet in the lower hopper portion of the unit. Dust Collector type/model must be field-proven. The dust collector shall have 99.9 percent weight arrestance efficiency according to ASHRAE 52.1. Fan shall be backward-inclined industrial blower capable of 11,800 liters /second at 2.5 kPa total static pressure. Fan package will include flanged inlet and outlet, quick clamp housing inspection door, housing drain coupling with gate valve, OSHA shaft and bearing guards, OSHA belt guard with expanded metal front, 37.3 kW. TEFC motor with variable pitch pulley, adjustable slide base, static and dynamic balanced, AMCA rated, and shipped assembled. Motor must meet or exceed EPA Act (Energy Policy Act) for efficiency on 60 cycle general-purpose motors. Unit will include manually adjustable outlet damper. The dust collector shall be fabricated with the housing stiffened to withstand 5000 Pa water gauge operating pressure and finished to withstand installation outside the building. All ventilation components and ducting shall be in compliance with the ACGIH-2093 and ANSI Z9.4. Differential Photohelic pressure gauge and alarm system shall be provided and installed to monitor the static pressure in the ducting, cartridges, and the blast enclosure. Provide high temperature Nylon tubing between the control panel and the dust collector housing. The tube fittings must be stainless steel. The alarm system shall alert operating personnel when a pressure change occurs, that is beyond manufacturer's recommended operating range.

2.4.1 Dust Collector Capacity and Dimensions

The air velocity within the enclosure must be no less than 0.51 meter per second for a cross draft ventilated room to conform to the requirements of ANSI Z9.4 and 29 CFR 1910.94. The blast room shall be arranged for cross draft end to end ventilation. Exhaust plenums shall be provided for connection to the dust collector and the abrasive blast room. They shall be constructed of 1.21 mm Type 316 stainless steel with 1.90 mm elbows. Plenums shall be located at the end of the room opposite roll-up doors. The plenums shall be installed on the sides of the Abrasive Blast Room as indicated. They shall be sized to maintain interior clearance and for minimum interior intrusion into the corners of the room. The exterior dimensions and weights of the dust collector vary according to manufacturer. The Contractor must coordinate the size of required mounting pad to accommodate the dust collector selected. Direct access shall be provided for a forklift truck to access the fines collection drum beneath the dust collector.

2.4.2 Ducting

Duct supports shall be designed to carry the weight of the duct system itself plus the anticipated weight of any conveyed materials. Since sprinkler protection is provided inside the duct system, the duct supports shall also be designed to support the anticipated weight of any

accumulation of sprinkler discharge. Conform to NFPA 91.

2.4.3 Dust Collector Accessories

A caged ladder and railed platform to meet 29 CFR 1910.27 requirements shall be furnished to provide access to dust collection components for repair and maintenance. Handrails, ladders, grating, and exterior elevated walkways shall be Type 316 stainless steel, anodized aluminum, structural fiberglass reinforced polyester (FRP) or extruded fiberglass. When appropriate, marine grade aluminum, defined as copper free alloy such as 5052 or 6063 will be used. All structural steel in non-air conditioned spaces shall be primed and painted as specified in Section 09900 PAINTS AND COATINGS.

2.4.4 Vertical Receiver

Dust collector cartridge filters use a large quantity of compressed air for back pulse filter cartridge cleaning. A 2500 L vertical compressed air receiver tank shall be provided as a reservoir for the back pulse air. The contractor is responsible for supplying a 50 mm diameter NPT air supply pipe to the vertical compressed air receiver tank for the dust collector back pulse compressed air system. Provide a compressed air line regulator and gauge to reduce 690 kPa air to 414-483 kPa to the diaphragm valve manifold, which provides reverse pulse air to cartridge filters. Failure to adjust the diaphragm valve manifold pressure may result in premature failure of the cartridge filters.

2.4.5 Photohelic Pressure Switch Gauge

Dust collector shall have Dwyer (or equal) Photohelic pressure switch gauge air control to control the duration and frequency of the pulse, with high/low settings and warning light to indicate high static pressure.

2.4.6 Control Tubing

Provide 6.25 mm O.D. Nylon tubing and Type 316 stainless steel connectors between the Photohelic pressure switch gauge panel and the dust collector tube manifold.

2.4.7 Cartridge Filters

Filters shall be Torit-Tex cartridge type filter, which have a high tolerance for moisture with a minimum filter surface area of 21.8 m²/cartridge. Filter efficiency shall be a minimum of 99.995 percent at 0.5 microns.

2.5 ABRASIVE BLAST EQUIPMENT

Abrasive Blasting Equipment shall support the use of stainless steel grit blasting media (SAE 330) and operate at up to (English equivalent) 862 kPa of compressed air.

2.5.1 Service Air

A Service Air Control Station shall supply a continuous flow of 862 kPa compressed air at a rate of 0.113 cubic meter per second to the blast machine. The control station shall be supplied from the building service air system. The control station shall consist of a manual cutoff valve, ball type, a line pressure indicator gauge with individual stop, a splitter

manifold for two solenoid cutoff valves, two manual stop valves and two bleeder cocks. The control station shall be configured and mounted in the vicinity of the blast machine and readily accessible by the system operator. All piping and valves will be installed to support an 862 kPa operational system and (English equivalent) 32-mm ID blast hose using 10 mm orifice nozzles. The general air system shall be tested at 1-1/2 times operating pressure (minimum).

2.5.2 Blast Machines

Provide one 0.283 cubic meter, stainless steel grit capacity, blast machine, located as indicated. One operator hose shall supply the west side of the Abrasive Blast Booth.

2.5.2.1 Pressure Vessel

The pressure vessel shall conform to all appropriate ASME regulations and carry a National Board approval certificate, with a rating of 862 kPa.

2.5.2.2 Media Flow Valve

Blast media flow valve shall be designed so that the manually adjustable metering function and the pneumatically operated valve actuation function are accomplished separately.

2.5.2.3 Blast Nozzles

Provide one silicon carbide nozzle, with a 10 mm orifice, with the blast machine. The Blast Nozzle shall be bonded and grounded to prevent the generation of static charges. When bonded and grounded, no component of the equipment specified herein shall have a resistance to ground greater than 25 ohms when such measurements are made in normally dry weather, not less than 48 hours after rainfall. This requirement shall exclude all components of this equipment which are designed, intended and identified as conductors of electrical current or, electrostatic potential. The blast nozzles shall be provided with a "dead man" type switch. The abrasive control switch shall be electrically operated for instant response over the entire operating length of the hose system.

2.5.2.4 Blast Hose

The blast hose, which conveys the compressed air and media to the blast nozzle, shall have an inside diameter of 32 mm, an outside diameter of 47 mm, and shall weight approximately 15.9 Kg per each 15.24 meter length. This hose shall be gum rubber lined and wrapped with a dual layer of tough nylon. The hose bib shall be rated at a working pressure of 1173 kPa. The hose lining shall be not less than 6.35 mm thick carbon black-impregnated rubber for static dissipation. It shall be fitted with lightweight, nylon quick disconnect couplings that mate externally and incorporate automatically interlocking safety wires.

2.5.2.5 Abrasive Cut-Off Switch

Provide an electric cut-off switch to allow the use of compressed air from the blast nozzle for duct blow down on blasted surfaces. This switch controls the opening and closing of the grit valve from the remote control handle.

2.5.2.6 Operator Remote Controls

Provide remote controls of the electric type, which incorporate a normally closed inlet valve and normally open outlet valve. Air pressure shall open the inlet valve and close the outlet valve to begin the blasting process. If there is a loss of air pressure to the valves, springs shall return the valves to their normal position.

2.6 ABRASIVE MATERIAL RECLAIM SYSTEM

A Cross screw recovery system shall remove stainless steel abrasives, dust and debris from the media pit and pass it to the reclamation equipment mounted on top of the abrasive supply hopper. This equipment shall separate usable steel grit from unusable materials and re-circulate clean abrasive to the blast unit. Unusable material shall either be returned to the dust collector or to a trash bin located in the equipment room. All components provided for this operation shall be of a size and capacity to permit continuous blasting for at least 60 minutes once the system has been filled to capacity, without interruption for adding additional abrasive.

2.6.1 Stainless Steel Grit Abrasive Media Reclaim Separator

Provide a rotating screen type separator having the function of removing large foreign particles from the stainless steel grit abrasive mixture. The screen assembly shall continuously and automatically discharge all foreign material, which will not pass through the screen mesh, to floor level by gravity spouting into a refuse hopper. A 5 percent carryover of usable grit (shot size SAE 280) is the maximum allowed. The abrasive shall gravitate from the screen to an abrasive air wash separator that shall remove the dust particles and unusable abrasive fines from the operating mixture in the recycling system. The compensating flow type separator is recommended for this application. In intermittent operations, the abrasive blast and resultant abrasive load delivered to the air wash separator varies in quantity. The separator shall separate unusable steel shot and route reusable stainless steel grit to the blast machine.

2.7 MAKE-UP AIR INTAKE SYSTEM

2.7.1 Materials and Fabrication

The air intake system consists of in-line centrifugal fans, stainless steel supply air duct, salt filters, factory supplied air intake filters, differential pressure gauge and pressure switch.

2.7.2 Supply Air Fans and Salt Filters

Provide supply air fans and salt filters as indicated on the drawings and in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS,

PART 3 EXECUTION

3.1 INSTALLATION

System installation shall be conducted in accordance with manufacturer's printed instructions.

3.2 VERIFICATION OF DIMENSIONS

Contractor shall be responsible for coordination and proper relation of all work to the building structure and the work of all trades. The Contractor shall verify all dimensions of the building in the field that relate to fabrication and installation of the ABS and notify the Contracting Officer of any discrepancy before final installation.

3.3 FIELD INSPECTIONS AND TESTS

A Pre-Acceptance, Acceptance and Post-Acceptance Test shall be conducted. The tests shall be performed by the Contractor as directed herein. A step-by-step test plan and report shall be provided by the Contractor for each test. The equipment specified herein shall be operated for not less than 30 minutes to determine compliance with the acceptance test requirements. Proper operation of controls and other accessories shall be inspected and demonstrated. Reports of all test data, analysis of performance and conclusions shall be prepared and submitted to the procuring activity.

3.3.1 Pre-Acceptance Test

Conduct pre-acceptance test on all electrical, mechanical and pneumatic devices and components of the ABS to determine if each component is operating properly and conforms to specifications. The tests shall be of sufficient depth to assure that every component of the system is exercised. Problems and deficiencies identified during this test shall be corrected prior to commencing the acceptance test. The following conditions shall be tested during the pre-acceptance test:

- a. Before operation of the system, test all piping for air systems at 1-1/2 times the working pressure of the system. After piping tests are complete, the system shall be operated.
- b. Observe flow of blasting media through recovery and separation cycle for indications of overloading system during blasting operations. Minimum requirements for the recovery and separation cycle are:
 - (1) Process 181 Kg per minute of stainless steel grit.
 - (2) A maximum of 5 percent carryover of usable grit to waste from the separator.
 - (3) Separator effectiveness of 95 percent in removing fines and unusable blast media (all shot that sizes less than SAE 280).
- c. Inspect exterior of blast enclosure for indications of dust and/or blasting media escaping from enclosure, no leakage allowed.
- d. Test all electric motors installed in the system to determine that the working load is not in excess of motor rated capacity.
- e. Verify the grounded connection to the operator's nozzle controls.
- f. Verify the cut-off action of the operator's nozzle and the refill reaction in the blast generator.
- g. Test and inspect for proper installation and operation all alarm

and warning signs specified.

- h. Verify rate of airflow through inlet louvers, across the blast room and from the exhauster.
- i. Inspect, test and verify discharge from exhauster that visible and particle emissions are within specified limitations. Maximum allowable visible emissions no greater than Number 1 on the Ringelmann chart and particulate matter not in excess of 5 milligrams per dry standard cubic foot of air.
- j. Verify that illumination within the Abrasive Blast System is equal to or greater than that specified.
- k. Inspect and verify operation of dust collector.

The pre-acceptance test shall be used as a training exercise for activity personnel.

3.3.2 Acceptance Test

The Acceptance Test for the Abrasive Blast System shall be conducted by trained personnel from the activity performed under the Contractor's supervision, during which normal equipment system operations shall be conducted. This phase shall also include a test of each and every system element, as in the pre-acceptance test and:

- a. Demonstrate the ability to support a 60-minute minimum blasting period as specified.
- b. Prepare a test plate or using a test piece provided by the procuring activity, demonstrate the ability of the system to provide a "near white" surface on that test piece.
- c. Demonstrate training effectiveness.

3.3.2.1 Performance

The ability of the blast system to support the blast times required can be based on the amount of time required for the nozzles to eject 0.018 cubic meter of blasting material times the amount of blasting material available in a fully charged system. An allowance of 15 percent standby will be allowed. Any device or component that fails or otherwise does not perform to specification standards, shall be repaired or replaced by the Contractor, and that portion of the system shall be re-tested to determine acceptance.

3.3.3 Dust Collector

The exhaust to the atmosphere from the dust collector shall be tested during the acceptance and post-acceptance test periods. To meet environmental air permit requirements, the dust collector shall attain not less than 99.9 percent control efficiency and shall meet all other permitting agency requirements. If the dust collector fails to meet these specified requirements, it shall be repaired or replaced by the Contractor, at no cost to the government.

3.3.3.1 Visible Emissions

At no time shall the dust collector discharge into the atmosphere, any air contaminant emission for a period or periods aggregating to more than 3 minutes in any period of 60 consecutive minutes, which is darker in than that designated as Number 1 on the Ringelmann chart as published by the United States Bureau of Mines, or of such opacity as to obscure an observers view to a degree greater than does smoke of a shade designated as Number 1 on the Ringelmann chart. For the purpose of this rule "observer" means a certified human observer or a certified and calibrated opacity monitoring system.

3.3.3.2 Nuisance

The dust collector shall not discharge from any source whatsoever such, quantities of air contaminates or other material which cause injury, detriment, nuisance, or annoyance to personnel or to the public, or which endanger the comfort, repose, health, or safety of personnel or the public, or which cause or have a tendency to cause, injury or damage to business or property.

3.3.3.3 Particulate Matter

The dust collector shall not discharge into the atmosphere, from any source, particulate matter in excess of 5 milligrams per dry standard cubic meter of air.

3.3.4 Blast Room Emissions

The emissions from the abrasive blast shall not exceed the limits specified in this section, or National or USAKA/KMR ambient air quality standards (NAAQS or SAAQS).

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SECTION 11504

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SECTION 11504

HYDRO BLAST SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z9.4 (1997) Ventilation and Safe Practices of
Abrasive Blast Operations

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1910.94 Ventilation

29 CFR 1910.134 Respiratory Protection

1.2 DESCRIPTION OF WORK

Provide a complete Hydro-Blast System. The principal components of the system are the Blast Room, Clear Fast/Deep Bed Water Filter Combination, Storage Tank, Settling Tank, Hydro-Blast Pump, Operator Safety Gear, Hydro Blast Compressed Air System, Breathing Air System, and Product Handling System. The Compressed Air System, the Breathing Air System, and the Product Handling System are specified in other sections of this specification as they also serve the Paint Spray Painting System. The work required under this section includes furnishing, installing, and testing new equipment. Provide rough in and make utility connections to equipment in accordance with requirements specified in other sections of this specification and in accordance with the physical dimensions, capacities and other requirements of the equipment furnished. Provide the hydro blast system as an Additive item in the Proposal Schedule.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Hydro Blast System

Residue Collector

Submit within 60 days of receipt of contract or notice to proceed a minimum 1:100-mm scale layout drawings of the hydro blast room and the hydro blast equipment room. Indicate the detailed arrangement of all Contractor supplied equipment, in their exact locations. Include elevations of the hydro blast equipment room, to establish that the equipment will fit the allotted spaces with clearance for installation, operation, and maintenance. Provide details of the air intake and exhaust system of the hydro blast equipment room.

SD-03 Product Data

Manufacturer's standard catalog data, at least 5 weeks prior to the purchase or installation of a particular component, highlighted to show material, size, options, performance charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Data shall include manufacturer's recommended installation instructions and procedures. Data shall be submitted for each of the specified component:

- a. Hydro Blast Pump
- b. Clear/Deep Bedwater Filter Combination
- c. Operator Safety Gear
- d. Breathing Air Supply System, purifiers, carbon monoxide monitor, alarm, filter, and hoses.

If the catalogs supplied refer to more than one model or type of equipment, the catalogs should be clearly annotated to show which product is being supplied under this contract.

Spare Parts Data

Spare parts data for each different item of equipment specified, after approval of detail drawings no later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of parts recommended by the manufacturer to be replaced on a routine basis.

Posted Instructions

Posted instructions, at least 4 weeks prior to construction completion, including equipment layout, wiring and control diagrams, piping, and control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventive maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions shall be framed under glass or laminated plastic and posted where indicated by the Contracting Officer.

Verification of Dimensions

A letter at least 4 weeks prior to beginning construction, including the date the site was visited, conformation of existing

conditions, and any discrepancies found.

System Performance Test

A schedule, at least 4 weeks prior to the start of related testing, for the system performance tests. The Schedules shall identify the proposed date, time, and location for each test.

Demonstrations

A schedule, at least 4 weeks prior to the date of the proposed training course, which identifies the date, time, and location of the training.

SD-06 Test Reports

System Performance Tests

Six copies of each test containing the information described below in bound 216 x 279 mm booklets. The report shall document compliance with the specified performance criteria upon completion of testing of the system. The report shall indicate the number of days covered by the tests and any conclusions as to the adequacy of the system.

- a. Clear/Deep Bedwater Filter Combination
- b. Hydro Blast Pump
- c. Operator Safety Gear
- d. Training Plan
- e. Test Plan & Record

SD-07 Certificates

Hydro Blast System

Provide a certificate of compliance with ANSI Z9.4 and 29 CFR 1910.

SD-10 Operation and Maintenance Data

Operation Manuals

Six complete copies of operation manual in bound 216 x 279 mm booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown at least 4 weeks prior to the first training course. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.

Maintenance Manuals

Six complete copies of maintenance manual in bound 216 x 279 mm booklets listing routine maintenance procedures, possible

breakdowns and repairs, and a trouble shooting guide. The manuals shall include equipment layouts and simplified wiring and control diagrams of the system as installed.

- a. Hydro Blast Pump
- b. Clear/Deep Bedwater Filter Combination

Submit operations and maintenance data in accordance with Section 01781 OPERATION AND MAINTENANCE DATA. In addition to the requirements of Section 01781 OPERATION AND MAINTENANCE DATA, submit the manual in a three-ring, hard cover, notebook. Provide index tabs that are specific to the required subject matter. Submit all drawings, illustrations, schematic and control, exploded views and diagrams that are stipulated by Section 01781 OPERATION AND MAINTENANCE DATA, in 216 x 279 mm or 279 mm x 432 mm format.

Submit one complete installation manual: an AutoCAD CD of electrical control system drawings, operating equipment and installation drawings to the Contracting Officer for review and approval, a minimum of 30 days prior to the performance of hydro blast room tests. Seven copies of the approved manuals with all test results included shall be provided to the Contracting Officer after completion of satisfactory system testing.

1.4 LOGISTICS

Should the Contractor or equipment manufacturer or vendor provide special parts of components which have been created specifically for the execution of this contract and not for the purpose of uniform model field change or product line modifications, then these items shall be identified at their field replacement level as specialty items in all listings of equipment, components, spare parts or consumables. The Contractor and equipment manufacturer or vendor shall provide to the Government all rights to manufacture, for the Government's own use, specialty items. The manufacturing data, process, drawings, artwork, machine control data, and programming data which are necessary to prepare the specialty item for field installation shall be provided to the Government at the time of equipment acceptance.

1.5 DELIVERY, STORAGE, AND HANDLING

Inspect each piece of equipment upon delivery. Obtain and follow equipment manufacturer's recommendations to protect materials and equipment and prevent damage.

1.6 SIGNS

Provide signs as required by Section 10440 INTERIOR SIGNAGE.

PART 2 PRODUCTS

2.1 HYDRO BLAST SYSTEM DESCRIPTION

The system will house all Hydro blasting equipment necessary to provide a hydro cleaning system using high-pressure water provided from the Hydro Blast Equipment Room. The system will produce a clean product ready for preservation and/or painting. The HBS will include a blasting room to

accommodate the varied size workload required. A compressed air system will be provided for hydro blasting equipment and breathing air. The compressed air and electrical systems will be installed in the hydro blast equipment room, which is separate from the Hydro Blast Room. The HBS shall include a complete electric system including appropriate controllers. Necessary electrical connections for the controllers are specified in Section 16415. All components of the HBS shall be compatible to meet the requirements of water recycling system, ventilation and cleaning without causing overload, excessive down time for maintenance of the system. Exhaust and supply ventilation shall be as specified in Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM. The supplier shall perform all work and testing required for the installation of the facility and all associated equipment.

2.2 ABRASIVE BLAST SYSTEM FABRICATION AND CONSTRUCTION

These requirements define the minimum design parameters for the HBS.

2.2.1 Maintainability

All components that might be subject to failure shall be positioned for ease of accessibility for replacement. Such items shall be standard items from the manufacturer's catalog. The equipment shall be designed for maintenance by Government maintenance personnel. The contractor shall specify which parts require periodic maintenance, overhaul, and replacement. A list of spare parts, including current prices shall be provided by the Contractor with equipment maintenance manuals. If special tools are required for maintenance, two sets shall be supplied. Provide a one year supply of maintenance parts and accessories as required.

2.2.2 Interchangeability

Interchangeability between components of the equipment identical in size and function shall be maximized. Parts and assemblies shall be manufactured to standards that permit replacement or adjustment without modification.

2.2.3 Safety

The design of the equipment shall incorporate sufficient safety devices and features in accordance with 29 CFR 1910, with emphasis on Sections 94, 132, 133, 134, 135, 136, 212 and 219 to ensure protection of personnel, equipment, and maintenance of the equipment. The equipment shall not present safety hazards when subjected to side load forces that may occur in a seismic zone one as defined in the International Building code. Emergency cut-off switches for rotating parts shall be placed throughout the hydro blast room and the hydro blast equipment room to manually de-energize equipment power to specific sections where continued operation of the equipment might result in damage to equipment or material or cause hazards to personnel.

2.2.3.1 Guards and Screens

Metal personnel safety guards shall be provided for normally accessible unducted fan inlets and discharges and moving power transmission components.

2.2.3.2 Mechanical Safety

Equipment operation shall continue to function when any piping, hoses, or

tubing system is subjected to twice the maximum nominal working pressure. Pressure vessels, valves, and fittings shall withstand proof pressures.

2.2.4 Electrical

The equipment shall use power from a 115 volt 60 Hertz single-phase source, and 440 volt, 60 Hertz, three-phase source. Sections 16415, "Electrical Work, Interior".

2.2.5 Controls and Alarms

Controls and alarms shall be located for convenient use and observation by the operator. Each control, indicator, and instrument shall be clearly and legibly marked for function and identification.

2.2.5.1 Power on Signal

A flashing red warning light shall be mounted over each access to the Hydro Blast Booth and shall automatically be activated when the HBS is in operation. A sign forbidding access except in an emergency while the red light is on shall be mounted in the vicinity of the warning light. The warning light and sign shall be visible from a distance of 15.3 meters (minimum).

2.2.5.2 Access Safety Interlocks

Safety Interlock switches shall be mounted on all access doors to the hydro blast room which will cut off power to the Hydro Blast System equipment if the doors are opened while the equipment is in operations.

2.2.5.3 Operator Signal

During Abrasive Blast System operation inside the abrasive blast room, the operator shall be alerted to interrupt operations by a flashing red light and horn activated by push buttons mounted on outside walls near each personnel access door. The operator interrupt signal shall be different from the carbon monoxide alarm. Place alarms as indicated on drawings.

2.2.6 Painting

Materials and color shall be the manufacturer's standard. All major equipment in non-air conditioned spaces shall be cleaned, primed and painted in shop, prior to shipment as specified in Section 09900 PAINTS AND COATINGS. Following installation, all external metal surfaces of equipment and piping other than moving parts, instrument panels or label plates, which are unpainted, prime painted or damaged shall be cleaned, primer painted as necessary and field painted in accordance with Section 09900 PAINTS AND COATING. All bolts, anchors, nuts and washers in non-air-conditioned spaces shall be Type 316 stainless steel.

2.2.7 Mechanical Devices

2.2.7.1 Gauges and Meters

Gauges and meters shall be in English units of measure and increments. Dual scale dials or indicator shall not be used. Gauges and meters shall be easily removable for maintenance and provisions shall be made for in-place calibration.

2.2.7.2 Equipment Access

Sufficient space shall be provided so that all equipment is accessible for operation and maintenance. Components shall be accessible for repair or replacement without necessitating the removal of any major equipment or components.

2.2.8 Transportability

Lifting eyes, handles, or other devices shall be provided on the equipment as necessary to permit safe movement of equipment for relocation and maintenance without exposing the equipment to damage, deformation or misalignment.

2.2.9 Color Coding

Controls, moving parts and piping shall be color coded in accordance with 29 CFR 1910 paragraph 144.

2.3 HYDRO BLAST ROOM MATERIALS AND FABRICATION

2.3.1 Lighting

The Hydro Blast Room shall be illuminated as indicated on drawings. Metal Halide type lamps shall be used and shall be installed in the Hydro Blast Room ceiling. The fixtures shall be designed as enclosed and UL listed for wet location, removable from inside the Hydro Blast Room, for the purpose of lamp maintenance and installation. Lighting shall conform to Section 16415A, ELECTRICAL WORK, INTERIOR.

2.3.2 Hydro Blast Room, Capacity and Dimensions

The blast room shall be sized as indicated.

2.3.3 Walls

The hydro blast walls shall be provided with a minimum 3.175 mm Type 316 stainless steel panels mounted to a minimum height of 2.4 meters above the finished floor. All concrete beneath stainless steel panels shall be waterproofed. All bolts, anchors, nuts and washers shall be Type 316 stainless steel. The design for all panels shall be standard for ease of replacement. The arrangement of the panels shall maximize the use of one common size.

2.3.4 Floor

The hydro blast room shall be installed on a hardened concrete floor rated at 27.5 MPa. The blast room floor shall be water-proofed and provided with a minimum 6.35 mm thick Type 316 stainless steel checkered plate mechanically fastened to the concrete with epoxy covered joints.

2.3.5 Hydro Blast Room, Accessories

One complete operator safety outfits that comply with ANSI Z9.4, 29 CFR 1910.94, and 29 CFR 1910.134 shall be provided. Outfits shall be provided with operator cooling air devices and CO Monitor.

a. (DELETED)

- b. Personal Air Conditioner: Provide one vest with vortex tube for consistent and continuous cooling. The vest shall allow full range of motion with no airflow restrictions and can be worn under welding leathers or protective clothing. The vortex tube shall be worn on a supplied belt, cool inlet temperature by 15.6 degree C, 225 kCal/hr, 425 SLPM capacity.
- c. Personal Mask: Provide one full mask with continuous flow of supplied air respirator made of silicone rubber, double sealing flange, polycarbonate lens, and removable hairnet. The personal mask shall be NIOSH approved.

2.4 HYDRO BLAST EQUIPMENT

Blasting Equipment shall operate at up to (40,000 PSI) 275,800 KPa water pressure.

2.4.1 Service Air

A Service Air Control Station shall supply a continuous flow of 862 KPa compressed air. The control station shall be supplied from the building service air system.

2.4.2 High Pressure Pump

- a. One each horizontal, positive displacement, triplex, plunger pump, rated 15.2 liter per second at 275,800 KPa (Actual Flow and Pressure) and equipped with the following standard features.
- b. Type 316 stainless steel pump head for long life and advanced kinematics which provide high volumetric efficiencies. The high efficiency reduces operating costs by minimizing power consumption.
- c. Pumphead mounted pressure regulator, manually operated, allowing for quick and easy pressure adjustment. The Pump will be capable of operating one jet gun without the need for splitter systems. A discharge flange located on the pump fluid end will have one connection to which the operator will connect one high pressure hose.
- d. Automatically resetting full lift safety valve prevents excessive pressurization. Once the pressure returns to an acceptable level, the valve resets and is immediately ready for operation. This eliminates time-consuming replacement of burst disks. No burst disc assemblies will be accepted as a means of safe guarding the system from over-pressurization.
- e. Dynamic plunger sealing automatically adjusts for packing wear, so no periodic adjustment is necessary. Packing system will not require any external means of lubrication or cooling. Oil lubricated packing systems will not be accepted.
- f. Ceramic plungers offer high wear resistance and long life, additionally the ceramic is a replaceable item and can be rebuilt saving you operating cost. Metal plungers of stainless steel chrome or nickel-plated plungers and tungsten plungers are unacceptable.
- g. Glycerin liquid filled pressure gauge assures accurate pressure

readings in harsh operating conditions. Liquid in pressure gauges will not be silicone.

- h. The pump design shall utilize State-of-the-art metallurgy: Type 316 stainless steel, stellites, ceramics and alloy steels to give long life and keep operating costs low.
- i. Pump shall have internal gear reduction via a crank and pinion shaft design to allow for direct drive through a flexible coupling for maximum efficiency thereby minimizing power consumption.
- j. Crankshaft must be a forged crankshaft providing a superior gear end with long life. The pump must also offer a forced oil lubrication, oil filtering, and cooling system to protect internal gears and bearings.
- k. The pump shall be driven by an electric motor, rated 74.6 kW at 1,750 RPM, T.E.F.C. 460 volts, 3 phase, 60 hz.
- l. A full voltage, non-reversing magnetic type starter shall be provided, rated 460 volts, 3 phase, 60 hz and equipped with 110 volt control circuit, on/off push buttons, and elapsed time indicator.
- m. Type 316 stainless steel pedestal mounted water reservoir (40 gallon) 151.4 liter shall be provided to ensure a constant water supply to the high pressure pump eliminating the risk of cavitation which is detrimental to positive displacement pumps.
- n. Critical functions such as low water level, high water temperature, engine oil pressure and temperature are monitored. In the event that any monitored function fails, the motor or pump will shut down for safety and to prevent expensive damage to the pump or motor.
- o. All items will be mounted on a heavy-duty skid type equipped with lifting eyes and mounting cleats.

2.4.2.1 Pressure Vessel

The pressure vessel shall conform to all appropriate ASME regulations and carry a National Board approval certificate, with a rating of 862 KPa.

2.4.2.2 Jetting Gun

The Jetting Gun shall be a positive shutoff dry-type jetting gun and incorporate in its design:

- a. Special valve design reducing chance of sudden recoil.
- b. Quick drop in nozzle loading design to allow change of nozzle quickly, easy, with no tools. No thread-on type nozzles are acceptable.
- c. Light weight.
- d. Rotary lock to prevent accidental use.
- e. Trigger Guard.

2.4.2.3 Nozzles

Nozzle shall be a single piece nozzle, insert type nozzle sealed by an O-ring, which makes it quick and simple to replace.

2.4.2.4 Hose

High Pressure Hose shall be 15 mm I.D. VHP hose rated at (English equivalent) 275,800 KPa working pressure.

2.4.2.5 Quick Disconnect Couplings

VHP quick-connect couplings shall be provided, which utilize a full circumference internal latching mechanism increasing safety.

2.4.2.6 Tool Kit

With the high-pressure pump, provide a customized tool repair kit, including any specialty wrenches to overhaul the wet-end.

PART 3 EXECUTION

3.1 INSTALLATION

System installation shall be conducted in accordance with manufacturer's printed instructions.

3.2 VERIFICATION OF DIMENSIONS

Contractor shall be responsible for coordination and proper relation of all work to the building structure and the work of all trades. The Contractor shall verify all dimensions of the building in the field that relate to fabrication and installation of the Hydro Blast System and notify the Contracting Officer of any discrepancy before final installation.

3.3 FIELD INSPECTIONS AND TESTS

A Pre-Acceptance, and Acceptance Test shall be conducted. The tests shall be performed by the Contractor as directed herein. A step-by-step test plan and report shall be provided by the Contractor for each test. The equipment specified herein shall be operated for not less than 30 minutes to determine compliance with the acceptance test requirements. Proper operation of controls and other accessories shall be inspected and demonstrated. Reports of all test data, analysis of performance and conclusions shall be prepared for submittal to the procuring activity.

3.3.1 Pre-Acceptance Test

Conduct pre-acceptance test on all electrical, mechanical and pneumatic devices and components of the HBS to determine if each component is operating properly and conforms to specifications. The tests shall be of sufficient depth to assure that every component of the system is exercised. Problems and deficiencies identified during this test shall be corrected prior to commencing the acceptance test. The following conditions shall be tested during the pre-acceptance test:

- a. Before operation of the system, test all piping for air systems (vertical receivers) at 1-1/2 times the working pressure of the

system. After piping tests are complete, the system shall be operated.

- b. Test all electric motors installed in the system to determine that the working load is not in excess of motor rated capacity.
- c. Verify the cut-off action of the operator's nozzle and the refill reaction in the blast generator.
- d. Test and inspect for proper installation and operation all alarm and warning signs specified.
- e. Verify rate of airflow through inlet louvers, across the blast room and from the exhauster.
- f. Inspect, test and verify discharge from exhauster that visible and particle emissions are within specified limitations. Maximum allowable visible emissions no greater than Number 1 on the Ringelmann chart and particulate matter not in excess of .1 grain per dry standard cubic foot of gas.
- g. Verify that illumination within the Hydro Blast room is equal to or greater than that specified; i.e. 700 lux candles at 0.91 meter above floor.

The pre-acceptance test shall be used as a training exercise for activity personnel.

3.3.2 Acceptance Test

The Acceptance Test for the Hydro Blast System shall be conducted by trained personnel from the activity performed under the Contractor's supervision, during which normal equipment system operations shall be conducted and witnessed by an activity personnel and the contracting officer. This phase shall also include a test of each and every system element, as in the pre-acceptance test and:

- a. Demonstrate the ability to support a 60-minute minimum blasting period as specified.
- b. Prepare a test plate or using a test piece provided by the procuring activity, demonstrate the ability of the system to provide a cleaned surface on that test piece.
- c. Demonstrate training effectiveness.

-- End of Section --

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DIVISION 11 - EQUIPMENT

SECTION 11505

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SECTION 11505

METALIZATION BOOTH

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 201 (1990) Fan Application Manual - Fans and Systems

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH-2093 (2001) Industrial Ventilation, Manual of Recommended Practice

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z9.4 (1997) Ventilation and Safe Practices of Abrasive Blast Operations

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 52.1 (1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 423 (2002) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM E 90 (1999) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.94 Ventilation

29 CFR 1910.95 Occupational Noise Exposure

29 CFR 1910.107 Spray Finishing Using Flammable and Combustible Materials

29 CFR 1910.134 (DELETED)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6 (2001) Enclosures for Industrial Controls Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 33 (2003) Standards for Spray Application Using Using Flammable or Combustible Materials

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES, INC. (UL)

UL 900 (1994; Rev thru Nov 1999) Test Performance of Air Filter Units

1.2 SCOPE OF WORK

Provide a complete Metalization booth system for metalizing military vehicles and equipment at the U.S. Army Kwajalein Atoll/Kwajalein Missile Range (USAKA/KMR). The military vehicles include pickup trucks, mini-vans, 2-1/2 and 5-ton trucks, Heavy Equipment Transporters (HET), Rough Terrain Container Handlers (RTCH), M105 trailers, 40-Ton cranes, 140-Ton cranes, M872 Trailers, M4K Forklifts, M10A Forklifts, 900 series trucks, M149 Water Buffaloes, and bulldozers.

1.3 DESCRIPTION OF WORK

Provide a Z275 galvanized pre-engineered acoustical Metalization Booth within the vehicle paint and prep building. The principal components of the Metalization Booth are the self-standing booth, Z275 galvanized metal panels, the Air Intake System, the Exhaust System, automatic Roll-up Doors, the Lighting System, Breathing Air Supply Piping System with, the Compressed Air (Service) Piping System, and the Electric Controls and Alarms. The Contractor shall furnish the supply piping and breathing air purifiers for both systems. The entire Metalization Booth facility compressed air-piping system is the responsibility of the Contractor. The work required under this section includes furnishing, installing and testing new equipment. Provide and make utility connections to equipment in accordance with the physical dimensions, capacities and other requirements of the equipment furnished.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Metalization Booth (acoustical)

Provide elevations showing the arrangement of the breathing air purifiers, supply piping and the compressed air outlet fixtures.

Provide details for the breathing air piping regulators and filters installation. Provide an elevation that indicates the lighting fixture installation in relation to the previously mentioned items. Lighting fixtures will be in accordance with NFPA 33, 2000 Edition, Paragraph 4.4. Fire sprinkler system will be the responsibility of the fire protection contractor.

Make up air system

Provide manufacturer's recommended installation procedures. Provide detailed drawings for Make up air unit and air salt pocket filters. Provide detailed drawings for Make up air supply delivery openings.

Dust Collector

Submit within 60 days of receipt of contract or notice to proceed, a minimum 1:100 scale layout drawings of the dust collection system. Indicate the detailed arrangement of all Contractor supplied equipment, in their exact locations. Include elevations of the dust collector.

Electric acoustical automatic Roll-up Metal Doors with manual override

Provide manufacturer's recommended installation procedures. Provide explosion proof motor with manual override capabilities. Interior pushbuttons for roll-up doors are to be explosion proof.

Lighting System

Provide manufacturer's recommended installation procedures. Provide details for the lighting fixtures and its supporting hardware. Provide details on interior access frames. Include details on servicing lighting fixtures in the operating and maintenance manual. Interlock the compressed (service) air supply with the opening of a lighting fixture.

Breathing Air purifiers and supply air piping to Metalization Booth

The booth manufacturer shall provide two Breathing air purifiers. Each Breathing purifier shall be capable of serving two breathable compressed air lines.

Compressed (Service) Air Supply Piping to Paint Booth

Comply with the requirements of Section 15400, "Compressed Air System" for specific system details.

Electrical Controls, Alarms & Starter Disconnect

Provide elevations that locate all paint booth control panels and electrical controls.

Two-stage Air Makeup Pocket Salt Filter and Metalization Booth Air Makeup Filter System

Electrical Distribution System

Provide a single line diagram of the "as-built" building electrical system and a schematic diagram of electrical control system. Locate all installed electric equipment.

SD-03 Product Data

Manufacturer's standard catalog data, at least 5 weeks prior to the purchase or installation of a particular component, highlighted to show material, size, options, performance charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Data shall include manufacturer's recommended installation instructions and procedures. Data shall be submitted for each of the specified component:

Metalization Booth (acoustical)

Make up air system

Dust Collector

Electric acoustical automatic Roll-up Metal Doors with manual override

Lighting System

Breathing Air purifiers and supply air piping to Metalization Booth

Compressed (Service) Air Supply Piping to Paint Booth

Electrical Controls, Alarms & Starter Disconnect

Two-stage Air Makeup Pocket Salt Filter and Metalization Booth Air Makeup Filter System

If the catalogs supplied refer to more than one model or type of equipment, the catalogs should be clearly annotated to show which product is being supplied under this contract.

Spare Parts Data

Spare parts data for each different item of equipment specified, after approval of detail drawings no later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of parts recommended by the manufacturer to be replaced on a routine basis.

Posted Instructions

Posted instructions, at least 4 weeks prior to construction completion, including equipment layout, wiring and control diagrams, piping, and control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventive maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions shall be framed under glass or laminated plastic and posted where indicated by the Contracting Officer.

Verification of Dimensions

A letter at least 4 weeks prior to beginning construction, including the date the site was visited, conformation of existing conditions, and any discrepancies found.

System Performance Test

A schedule, at least 4 weeks prior to the start of related testing, for the system performance tests. The Schedules shall identify the proposed date, time, and location for each test.

Demonstrations

A schedule, at least 4 weeks prior to the date of the proposed training course, which identifies the date, time, and location of the training.

SD-05 Design Data

Metalization Booth - Ventilation Calculations

Provide calculations stamped and signed by a Registered Professional Engineer, for all design data submittals.

SD-06 Test Reports

System Performance Tests

Six copies of each test containing the information described below in bound 216 x 279 mm booklets. The report shall document compliance with the specified performance criteria upon completion of testing of the system. The report shall indicate the number of days covered by the tests and any conclusions as to the adequacy of the system.

Metalization Booth

Dust Collector

Breathing Air Supply System, purifiers, carbon monoxide monitor, alarm, filter, and hoses

SD-07 Certificates

Metalization Booth

Dust Collector

Provide Certificate of Compliance in writing of satisfactory compliance with 29 CFR 1910.107, NFPA 70 and NFPA 33, 2000 Edition regulations with the exception that the designed airflow shall be not less than 0.255 m/sec for downdraft exhaust systems.

SD-10 Operation and Maintenance Data

Operation Manuals

Six complete copies of operation manual in bound 216 x 279 mm booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown at least 4 weeks prior to the first training course. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.

Maintenance Manuals

Six complete copies of maintenance manual in bound 216 x 279 mm booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include equipment layouts and simplified wiring and control diagrams of the system as installed.

Metalization Booth

Dust Collector

Electrical Controls, Alarms & Starter Disconnect

Electric acoustical automatic Roll-up Metal Doors with manual override

Submit operation and maintenance data in accordance with Section 01781 OPERATION AND MAINTENANCE DATA. Submit one complete installation manual: an AutoCAD CD of electrical control system drawings, operating equipment and installation drawings to the Contracting Officer for review and approval, a minimum of thirty days prior to the start of the Spray Paint Room system tests. Provide seven copies of approved manuals with all test results included, to the Contracting Officer after the completion and acceptance of system tests.

Posted Operating Instructions

Provide sample operating instructions for approval to the Contracting Officer. A complete set of the approved operating instructions shall be posted prior to system testing. Provide signs required by 29 CFR 1910.95 and 29 CFR 1910.107. Prepare Operating Instructions and other signs as specified in Section 10440 INTERIOR SIGNAGE.

1.5 LOGISTICS

Should the Contractor or equipment manufacturer or vendor provide special electronic circuits which have been created specifically for the execution of this contract and not for the purpose of uniform model field change of product line modification, then these items shall be identified at their field replacement levels as specialty items in all listings of equipment, components, spare parts or consumables. The Contractor and equipment manufacturer or vendor shall provide to the Government all rights to manufacture, for the Government's own use, specialty items. The manufacturing data, process, drawings, artwork, machine control data, and programming data which are necessary to prepare the specialty item for field installation shall be provided to the Government at the time for equipment acceptance.

1.6 SIGNS

Provide signs as specified in accordance with the requirements of Section 10440 INTERIOR SIGNAGE.

PART 2 PRODUCTS

2.1 METALIZATION BOOTH DESCRIPTION

The Metalization Booth consists of an Automatic acoustical Metal Roll-Up Doors with Manual Override, Air Make Up System, Dust collector, Lighting System, Breathing Air Piping System, Compressed Air Piping System, Controls and Alarms, and the Electrical Distribution System. Breathing air and compressed air shall be supplied to the booth. The supply piping for both systems shall be furnished by the Contractor.

2.2 METALIZATION BOOTH

2.2.1 Materials and Fabrication

The Metalization Booth shall be fabricated for a side-downdraft exhaust ventilation system. The interior liner panels of the Metalization room shall be fabricated from 1.90 mm thick Z275 hot dipped galvanized sheet steel (minimum). Panels shall be comprised of a single wall 4" thick hard construction with solid exterior walls, and bolted together with gaskets that will prevent leakage. All bolts, anchors, nuts and washers in non-air-conditioned spaces shall be Type 316 stainless steel. The interior walls and roof of the metalization area shall be perforated and have a minimum sound transmission class (STC) rating of 40 as tested in accordance with ASTM E 90 and Noise reduction coefficient (NRC) of 0.095 tested accordance with ASTM C 423. Three personnel doors shall be provided as specified in Section 08115 STAINLESS STEEL DOORS AND FRAMES and as indicated on the drawings. The single leaf personnel doors of the metalization booth shall be supplied with installed interior aluminum panic type hardware. All required door limit switches and control interlocks are to de-energize the compressed air supply if a roll-up door, or personnel door is opened during the metalization operation. If switches or powered door pushbuttons are located inside of the booth, or the hazardous zone adjacent to the metalization booth, the switches and pushbuttons shall be explosion proof.

2.2.2 Capacity and Dimensions

The minimum clear working area of the spray area enclosure shall be 6.1 meters high by 7.92 meters wide by 18.3 meters deep.

2.2.3 Automatic Metal Roll-Up Doors with Manual Override

2.2.3.1 Materials and Fabrication

The acoustical roll-up door system shall be a dual (one inside and outside) roll-up door. The overhead roll-up door system shall be heavy gauge, galvanized steel. Door system to include acoustical seals and sound absorptive treatment in the inner space. The doors shall be provided with a sensor to detect the door in a closed position. Both doors to be power actuated with push button controls.

2.2.4 Air Make up System

Provide booth mounted intake air silencer, Type 316 stainless steel as shown on the drawing. Air Intake filters shall not support combustion and shall have a UL 900, Class 2 rating. Filters shall not interfere with the efficiency of dust collection operation and shall minimize creation of dead air pockets. Back-draft dampers shall open when the paint room exhaust fans are running. The filters shall be replaceable from the interior of the paint room. The filter media shall be dry type, replaceable filters. The filters shall be fabricated from polyester fabric that are treated to provide a dust trapping capability. Air intake filters shall be the same size. Replacement filters shall be standard catalog items that are manufactured and sold as air intake filters, and are readily available from sources. Manufacturer shall design filters and make-up supply air opening in booth to maintain predetermined airflow of 11,799 L/s. Provide a differential pressure gauge and pressure switch. The gauge shall be graduated to show pressure drop when air filters needs to be replaced.

2.2.5 Dust Collector System

Fan arrangements should be selected to eliminate system effects identified in AMCA 201. Ventilation and dust collection equipment shall prevent dust escaping from the enclosure and provide visibility within the booth to the levels established by 29 CFR 1910.94. The system shall be designed and arranged to provide a negative pressure in the room and prevent dust escaping from the room. The fan shall be of sufficient capacity to provide air velocity of at least 1.53 meters per second at the louvered air inlet openings and 0.51 meters per second of cross draft ventilation. Unit shall contain a combined total filter area of at least 4,515 square meters, with an air-to-media ratio not to exceed 0.51:1. Unit shall utilize a factory-supplied abrasion-resistant inlet to minimize the effects of abrasive particulate in the air stream. Dirty air inlet must be on the top-side of the cartridge housing, creating a downward airflow direction inside the unit. Provide pulse valves and dust cartridge as per manufacturer's recommendation. Do not locate the dirty air inlet in the lower hopper portion of the unit. Dust Collector type/model must be field-proven. The dust collector shall have 99.9 percent weight arrestance efficiency according to ASHRAE 52.1. Fan shall be backward-inclined industrial blower capable of 11,799 liters/second at 2.5 KPa total static pressure. Fan package will include flanged inlet and outlet, quick clamp housing inspection door, housing drain coupling with gate valve, OSHA shaft and bearing guards, OSHA belt guard with expanded metal front, 74.6 kW. TEFC motor with variable pitch pulley, adjustable slide base, static and dynamic balanced, AMCA rated, and shipped assembled. Motor must meet or exceed EPAct (Energy Policy Act) for efficiency on 60 cycle general-purpose motors. Unit will include manually adjustable outlet damper. The dust collector shall be fabricated with the housing stiffened to withstand 5000 Pa water gauge operating pressure and finished to withstand installation outside the building. The dust collector shall be galvanized steel and finish shall be primed and painted in accordance with Section 09900 PAINTS AND COATING. All ventilation components and ducting shall be in compliance with the ACGIH-2093 and ANSI Z9.4. Differential Photohelic pressure gauge and alarm system shall be provided and installed to monitor the static pressure in the ducting, cartridges, and the blast enclosure. Provide high temperature nylon tubing between the control panel and the dust collector housing. The tube fittings must be stainless steel. The alarm system shall alert operating personnel when a pressure change occurs, that is beyond manufacturer's recommended operating range.

2.2.5.1 Exhaust Plenum and Ductwork

- a. The exhaust plenums shall be constructed of 1.21 mm (minimum) Z275 hot-dipped galvanized steel with panels. All distribution of baffle plates, if any, shall be made of non-combustible material and shall be readily removable or accessible on both sides for cleaning.
- b. Installation shall include all necessary reinforcements, bracing, supports, framing, gasketing and fastening to guarantee rigid construction and freedom from vibration, airflow induced motion, and excessive deflection. The exhaust plenums shall be designed to support the exhaust ductwork and the weight of necessary maintenance personnel. The installation and use of these items must not interfere with the airtight integrity of the plenum's rear wall. Duct supports shall be designed to carry the weight of the duct system itself plus the anticipated weight of any conveyed materials. Since sprinkler protection shall be provided inside the duct system, the duct support shall also be designed to carry the anticipated weight of any accumulation of sprinkler discharge. Laps in duct construction shall be in the direction of airflow. Access doors shall be provided in horizontal ducts adjacent to elbows, junctions, and vertical ducts. Doors shall be located on the tops or sides of the ducts, and door spacing shall not exceed 3.6 m.

2.2.6 Lighting System

2.2.6.1 Materials and Fabrication

Provide and install enclosed fluorescent light fixtures, each with four 1219 mm, and OSRAM Sylvania F40/DSGN50, Design 50 fixtures with a color rendering index (CRI) of 90.

2.2.6.2 Capacity and Dimensions

Provide a minimum of 1000 Lux of illumination when measured 914 mm above the finished floor in the center of the Metalization booth.

2.2.7 Control System

2.2.7.1 Material and Fabrication

The Metalization Building shall include a complete electric system with appropriate controllers. Enclosures for controls shall conform to NEMA ICS 6 and Division 16 Sections of these Specifications. Electrical wiring and equipment not subject to deposits of combustible residues but located in a spraying area as herein defined shall be of explosion-proof type approved for Class I, Group D locations and shall otherwise conform to the provisions of subpart S for Class I, Division 1, Hazardous Locations. Electrical wiring, motors, and other equipment outside of but within 6.15 meters of any spraying area, and not separated therefrom by partitions, shall not produce sparks under normal operating conditions and shall otherwise conform to the provisions of subpart S of this part for Class I, Division 2 Hazardous Locations. All metal parts of metalization booth, exhaust ducts, and piping systems conveying flammable or combustible liquids or aerated solids shall be properly electrically grounded in an effective and permanent manner. Enclosures for control panels, lighting and controls for the exhaust vent motor shall be installed as indicated on

the drawings. All enclosures shall be watertight and weatherproof. Motor controls shall be provided with a "power on" indicating light. Operating instructions shall be provided on laminated acrylic plastic plaques. The plaques shall be a minimum of 216 mm wide by 279 mm long by 3.17 mm thick with a matte finish. The necessary graphics and lettering shall be applied to the rear surface of white plastic sheet by silk screening prior to applying the clear cover laminate. Typeface shall be Helvetica medium, 14 point font, and of black color. The plaques shall be encased in aluminum frames and mounted near the equipment's control panel with appropriate screw fasteners.

2.2.7.2 Capacity and Dimensions

The control panel(s) shall be labeled to indicate function, use, and sequence of operation. The room dust collector shall operate on 460 volt ac, 60 Hz, 3 phase, and the lighting shall operate on 277 volt ac, 60Hz, 1 phase power source.

2.2.8 Controls and Alarms

2.2.8.1 Materials and Fabrication

Provide an electrically controlled valve that will interrupt the air supply system to the spray gun when the exhaust ventilation system is not operating or when the clogged filter alarm is activated. Provide an audio/visual alarm for clogged exhaust filters. Fire sprinklers shall be provided in the Metalization area enclosure and exhaust assembly as required by NFPA 33. Alarm shall be suitable for use in a Class 1, Division I, location in accordance with NFPA 70.

2.3 (DELETED)

2.4 PERSONAL AIR CONDITIONER

Provide two vests with vortex tube for consistent and continuous cooling. The vest shall allow full range of motion with no airflow restrictions and can be worn under welding leathers or protective clothing. The vortex tube shall be worn on a supplied belt, cool inlet temperature by 15.6 degree C, 225 kCal/hr, 425 SLPM capacity.

2.5 PERSONAL MASK

Provide two full masks with continuous flow of supplied air respirator made of silicone rubber, double sealing flange, polycarbonate lens, and removable hairnet. The personal mask shall be NIOSH approved.

PART 3 EXECUTION

3.1 INSTALLATION

The components of the metalization booth shall be installed as specified herein.

3.2 VERIFICATION OF DIMENSIONS

Contractor shall be responsible for coordination and proper relation of all work to the building structure and the work of all trades. Verify all dimensions that relate to the fabrication of the Metalization booth.

3.3 FIELD INSPECTIONS AND TESTS

Schedule and administer operational tests and inspections. Furnish personnel, instruments and apparatus to perform tests and inspections. Correct defects and repeat the respective inspections and tests. Give the Contracting Officer ample notice of the dates and times scheduled for tests and trial operation. Give at least 5 days prior notice for the respective tests and inspections.

3.3.1 Pre-Installation Inspection

Before installation, inspect all components of the Metalization Booth to determine compliance with specification and manufacturer's data and shop drawings as approved.

3.3.2 Operational Tests and Inspections

Upon completion and before final acceptance, operate the Spray Paint Booth system. During operation, inspect and test the system to determine that each component of the system operates as specified is properly installed and adjusted, is free from defects in material, test and make final adjustment of the equipment in accordance with this specification and the manufacturer's specifications. Ensure that Contracting Officer approved operating instructions are posted prior to starting system tests.

3.3.3 Additional Tests

3.3.3.1 Sound Level

Conduct sound level readings outside Metalization Booth, 3.05 meters from the center of the exhaust fan, during operational in-service tests. Sound level not to exceed 84 dBA on Scale 'A' of a standard sound level meter at slow response. Conform to the requirements of 29 CFR 1910.95. If the sound level readings are recorded in excess of those specified, the Contractor shall install sound attenuators to reduce level of sound and the system re-tested. This procedure shall be repeated until specified sound level is obtained at no additional cost to the Government.

3.3.3.2 Air Flow Velocity

The airflow velocity shall be measured at the center at 4 points in of the metalization area enclosure with 1/2 of the exhaust filters blocked. The 4 points shall be selected diagonally from each corner of the enclosure not more than 1.5 m from each corner and also in front of the exhaust plenums. The exhaust air velocity shall be a minimum of 0.255 meters per second. The system shall be balanced to prevent any turbulence. The airflow measurements at each corner shall not vary more than 15 percent, one from the other. Failure to achieve this balance will be cause for re-balancing and retest. This procedure shall be repeated until the specified airflow is achieved.

3.3.3.3 Safety Shut-Down of Air Supply

A demonstration shall be conducted to prove that the compressed air supply to all spray guns will automatically shut down when the exhaust fan is de-energized, a filter is clogged, a door is opened, or a lighting fixture is open.

3.3.3.4 Adjustments

Balance the Dust collector's to manufacturer's specifications.

-- End of Section --

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SECTION 13851A

FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a (2003) Approval Guide Fire Protection

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Surge Voltages in
Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

NFPA 72 (2002) National Fire Alarm Code

NFPA 90A (2002) Installation of Air-Conditioning
and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 1242 (1996; Rev Mar 1998) Intermediate Metal
Conduit

UL 1971 (1995; Rev thru Apr 1999) Signaling
Devices for the Hearing Impaired

UL 268 (1996; Rev thru Jan 1999) Smoke Detectors
for Fire Protective Signaling Systems

UL 268A (1998) Smoke Detectors for Duct Application

UL 38 (1999) Manually Actuated Signaling Boxes
for Use with Fire-Protective Signaling
Systems

UL 464 (1996; Rev thru May 1999) Audible Signal
Appliances

UL 521 (1999) Heat Detectors for Fire Protective
Signaling Systems

UL 6 (1997) Rigid Metal Conduit

UL 632	(2000) Electrically-Actuated Transmitters
UL 797	(1993; Rev thru Mar 1997) Electrical Metallic Tubing
UL 864	(1996; Rev thru Mar 1999) Control Units for Fire Protective Signaling Systems
UL Fire Prot Dir	(2004) Fire Protection Equipment Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fire Alarm Reporting System; G

Detail drawings, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical detectors. The Contractor shall check the layout based on the actual detectors to be installed and make any necessary revisions in the detail drawings. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Detailed point-to-point wiring diagram shall be prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician showing points of connection. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and equipment that is activated or controlled by the panel.

SD-03 Product Data

Storage Batteries; G

Substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included.

Voltage Drop; G

Voltage drop calculations for notification appliance circuits to indicate that sufficient voltage is available for proper appliance operation.

Special Tools and Spare Parts; G

Spare parts data for each different item of material and equipment specified, not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.

Technical Data and Computer Software; G

Technical data which relates to computer software.

Training; G

Lesson plans, operating instructions, maintenance procedures, and training data, furnished in manual format, for the training courses. The operations training shall familiarize designated government personnel with proper operation of the fire alarm system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

Testing; G

Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, for the fire detection and alarm system 60 days prior to performing system tests.

SD-06 Test Reports

Testing; G

Test reports, in booklet form, showing field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall document readings, test results and indicate the final position of controls. The Contractor shall include the NFPA 72 Certificate of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

SD-07 Certificates

Equipment; G

Certified copies of current approvals or listings issued by an independent test lab if not listed by UL, FM or other nationally recognized testing laboratory, showing compliance with specified NFPA standards.

Qualifications; G

Proof of qualifications for required personnel. The installer shall submit proof of experience for the Professional Engineer, fire alarm technician, and the installing company.

SD-10 Operation and Maintenance Data

Technical Data and Computer Software; G

Six copies of operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features. Six copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements. Original and backup copies of all software delivered for this project shall be provided, on each type of media utilized. Manuals shall be approved prior to training.

1.3 GENERAL REQUIREMENTS

1.3.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours of notification.

1.3.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

1.3.3 Keys and Locks

Locks shall be keyed alike. Four keys for the system shall be provided.

1.3.4 Tags

Tags with stamped identification number shall be furnished for keys and locks.

1.3.5 Verification of Dimensions

After becoming familiar with details of the work, the Contractor shall verify dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

1.3.6 Compliance

The fire detection and alarm system and the central reporting system shall be configured in accordance with NFPA 72; exceptions are acceptable as directed by the Contracting Officer. The equipment furnished shall be compatible and be UL listed (UL Fire Prot Dir), FM approved (FM P7825a), or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

1.3.7 Qualifications

1.3.7.1 Engineer and Technician

- a. Registered Professional Engineer with verification of experience and at least 4 years of current experience in the design of the fire protection and detection systems.
- b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems program with verification of experience and current NICET certificate.
- c. The Registered Professional Engineer may perform all required items under this specification. The NICET Fire Alarm Technician shall perform only the items allowed by the specific category of certification held.

1.3.7.2 Installer

The installing Contractor shall provide the following: A NICET Level 3 Fire Alarm Technician shall supervise the installation of the fire alarm system. An electrician or NICET Level 1 Fire Alarm Technician shall install conduit for the fire alarm system. A Fire Alarm Technician with a minimum of 4 years of experience shall perform/supervise the installation of the fire alarm system. Fire Alarm Technicians with a minimum of 2 years of experience shall be utilized to assist in the installation and terminate fire alarm devices, cabinets and panels. An electrician shall be allowed to install wire or cable and to install conduit for the fire alarm system. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.3.7.3 Design Services

Installations requiring designs or modifications of fire detection, fire alarm, or fire suppression systems shall require the services and review of a qualified fire protection engineer. For the purposes of meeting this requirement, a qualified fire protection engineer is defined as an individual meeting one of the following conditions:

- a. An engineer having a Bachelor of Science or Masters of Science Degree in Fire Protection Engineering from an accredited university engineering program, plus a minimum of 2 years' work experience in fire protection engineering.
- b. A registered professional engineer (P.E.) in fire protection engineering.
- c. A registered PE in a related engineering discipline and member grade status in the National Society of Fire Protection Engineers.
- d. An engineer with a minimum of 10 years' experience in fire protection engineering and member grade status in the National Society of Fire Protection Engineers.

1.4 SYSTEM DESIGN

1.4.1 Operation

The fire alarm and detection system shall be a complete, supervised fire alarm reporting system. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm initiating devices shall be connected to initiating device circuits (IDC), Class A, Style D, to signal line circuits (SLC), Class A, Style 6, in accordance with NFPA 72. Alarm notification appliances shall be connected to notification appliance circuits (NAC), Class A, Style Z in accordance with NFPA 72. A looped conduit system shall be provided so that if the conduit and all conductors within are severed at any point, all IDC, NAC and SLC will remain functional. The conduit loop requirement is not applicable to the signal transmission link from the local panels (at the protected premises) to the Supervising Station (fire station, fire alarm central communication center). Textual, audible, and visual appliances and systems shall comply with NFPA 72. Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc. Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits and shall provide the following features:

- a. Sufficient memory to perform as specified and as shown for addressable system.
- b. Individual identity of each addressable device for the following conditions: alarm; trouble; open; short; and appliances missing/failed remote detector - sensitivity adjustment from the panel for smoke detectors
- c. Capability of each addressable device being individually disabled or enabled from the panel.
- d. Each SLC shall be sized to provide 40 percent addressable expansion without hardware modifications to the panel.

1.4.2 Operational Features

The system shall have the following operating features:

- a. Monitor electrical supervision of IDC, SLC, and NAC. Smoke detectors shall have combined alarm initiating and power circuits.
- b. Monitor electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.
- c. A trouble buzzer and trouble LED/LCD (light emitting diode/liquid crystal diode) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. A trouble alarm silence switch shall be provided which will silence the trouble

buzzer, but will not extinguish the trouble indicator LED/LCD. Subsequent trouble and supervisory alarms shall sound the trouble signal until silenced. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

- d. A one person test mode. Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.
- e. Evacuation alarm silencing switch which, when activated, will silence alarm devices, but will not affect the zone indicating LED/LCD nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed device and the NAC devices will be activated.
- f. Electrical supervision for circuits used for supervisory signal services (i.e., sprinkler systems, valves, etc.). Supervision shall detect any open, short, or ground.
- g. Confirmation or verification of all smoke detectors. The control panel shall interrupt the transmission of an alarm signal to the system control panel for a factory preset period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 20 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal, if present, will be sent immediately to the control panel. Fire alarm devices other than smoke detectors shall be programmed without confirmation or verification.
- h. The fire alarm control panel shall provide supervised addressable relays for HVAC shutdown. An override at the HVAC panel shall not be provided.
- i. The fire alarm control panel shall monitor the fire sprinkler system.
- j. The control panel and field panels shall be software reprogrammable to enable expansion or modification of the system without replacement of hardware or firmware. Examples of required changes are: adding or deleting devices or zones; changing system responses to particular input signals; programming certain input signals to activate auxiliary devices.

1.4.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate functions as indicated on the drawings.

1.4.4 Primary Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of

any initiating circuit.

1.4.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

1.4.6 Interface With other Equipment

Interfacing components shall be furnished as required to connect to subsystems or devices which interact with the fire alarm system, such as supervisory or alarm contacts in suppression systems, operating interfaces for duct smoke detectors, the fire pump controller, etc.

1.5 TECHNICAL DATA AND COMPUTER SOFTWARE

Technical data and computer software (meaning technical data which relates to computer software) which is specifically identified in this project, and which may be defined/required in other specifications, shall be delivered, strictly in accordance with the CONTRACT CLAUSES, and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

- (1) Identification of programmable portions of system equipment and capabilities.
- (2) Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.
- (3) Provision of operational software data on all modes of programmable portions of the fire alarm and detection system.
- (4) Description of Fire Alarm Control Panel equipment operation.
- (5) Description of auxiliary and remote equipment operations.
- (6) Library of application software.
- (7) Operation and maintenance manuals as specified in SD-19 of the Submittals paragraph.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt, dust, and any other contaminants.

PART 2 PRODUCTS

2.1 CONTROL PANEL

Control Panel shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a semi-flush mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean,

uncluttered, and orderly assembled panel containing components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for LED/LCDs, zones, SLC, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. The LED/LCD displays shall be located on the exterior of the cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means (single operation) shall be provided for testing the control panel visual indicating devices (meters or LEDs/LCDs). Meters and LEDs shall be plainly visible when the cabinet door is closed. Signals and LEDs/LCDs shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Each IDC shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other devices. Loss of power, including batteries, shall not require the manual reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals. Visual annunciation shall be provided for LED/LCD visual display as an integral part of the control panel and shall identify with a word description and id number each device. Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate units. Cabinets shall be painted red.

2.1.1 Circuit Connections

Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each conductor and terminal marked for identification.

2.1.2 System Expansion and Modification Capabilities

Any equipment and software needed by qualified technicians to implement future changes to the fire alarm system shall be provided as part of this contract.

2.1.3 Addressable Control Module

The control module shall be capable of operating as a relay (dry contact form C) for interfacing the control panel with other systems. The module shall be UL listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Style Y notification appliance circuits. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. The control model shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled.

2.1.4 Addressable Initiating Device Circuits Module

The initiating device being monitored shall be configured as a Class B, Style B initiating device circuits. The system shall be capable of defining any module as an alarm module and report alarm trouble, loss of

polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling. The module shall be UL listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED.

2.1.5 Isolation Modules

Provide isolation modules to isolate wire-to-wire short circuits on a loop and limit the number of other modules or sensors that are incapacitated by the short circuit fault. Place isolator modules on signaling line circuits such that not more than 30 addressable devices are connected between isolation modules or as indicated on the drawings. If a wire-to-wire short occurs, the module shall automatically open the circuit. On repair of the short, the module shall automatically reconnect the isolated section of the signaling line circuit. The module shall mount in a 100 mm square electrical box. Module shall contain an integral LED that flashes each time the module is polled and illuminates steadily to indicate that a short has been detected and isolated.

2.2 STORAGE BATTERIES

Storage batteries shall be provided and shall be 24 Vdc sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 72 hours. Following this period of battery operation, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 15 minutes. Batteries shall be located either at the bottom of the panel or in a separate battery cabinet. Batteries shall be provided with overcurrent protection in accordance with NFPA 72. Separate battery cabinets shall have a lockable, hinged cover similar to the fire alarm panel. The lock shall be keyed the same as the fire alarm control panel. Cabinets shall be painted to match the fire alarm control panel.

2.3 BATTERY CHARGER

Battery charger shall be completely automatic, 24 Vdc with high/low charging rate, capable of restoring the batteries from full discharge (18 Volts dc) to full charge within 48 hours. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly, if a high rate switch is provided. Charger shall be located in control panel cabinet or in a separate battery cabinet.

2.4 ADDRESSABLE MANUAL FIRE ALARM STATIONS

Addressable manual fire alarm stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into signal line circuits. Stations shall be installed on surface mounted outlet boxes in unfinished areas and flush mounted outlet boxes in finished areas. Manual stations shall be mounted at 1220 mm from the top to the finished floor. Stations shall be single action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of

a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Addressable pull stations shall be capable of being field programmed, shall latch upon operation and remain latched until manually reset. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be matched and painted the same color as the fire alarm manual stations. Manual stations located in hazardous locations shall be suitable for Class I Division 1, Group D as indicated on the drawings. **Provide weatherproof devices where indicated on the drawings.**

2.5 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, UL 268A, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors located in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD. Addressable fire detecting devices, except flame detectors, shall be dynamically supervised and uniquely identified in the control panel. All fire alarm initiating devices shall be individually addressable, except where indicated. Installed devices shall conform to NFPA 70 hazard classification of the area where devices are to be installed.

2.5.1 Smoke Detectors

Smoke detectors shall be designed for detection of abnormal smoke densities. Smoke detectors shall be photoelectric type. Detectors shall contain a visible indicator LED/LCD that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making wiring connections. Detectors that are to be installed in concealed (above false ceilings, etc.) locations shall be provided with a remote indicator LED/LCD suitable for mounting in a finished, visible location.

2.5.1.1 Photoelectric Detectors

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating in accordance with UL 268. Addressable smoke detectors shall be capable of having the sensitivity being remotely adjusted by the control panel.

2.5.1.2 Duct Detectors

Duct-mounted photoelectric smoke detectors shall be furnished and installed where indicated and in accordance with NFPA 90A. Units shall consist of a smoke detector as specified in paragraph Photoelectric Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between 2.5 and 20 m/s. Detectors shall be powered from the fire alarm panel. Sampling tubes shall run the full width of the duct. The duct detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from

the fire alarm control panel. Lights to indicate the operation and alarm condition; and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Detectors mounted above 1.83 m and those mounted below 1.83 m that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test and reset switches. Remote lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

2.6 NOTIFICATION APPLIANCES

Audible appliances shall conform to the applicable requirements of UL 464. Devices shall be connected into notification appliance circuits. Devices shall have a separate screw terminal for each conductor. Audible appliances shall generate a unique audible sound from other devices provided in the building and surrounding area. Surface mounted audible appliances shall be painted red. Recessed audible appliances shall be installed with a grill that is painted red. Devices in hazardous locations shall be suitable for Class I, Division 1, Group D areas as indicated on the drawings. **Provide weatherproof devices where indicated on the drawings.**

2.6.1 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box surface mounted in unfinished areas and recessed in finished areas, vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a sound rating of at least 85 dBA at 3.05 m in office areas and 95 dBA at 3.05 m in work areas. Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles. Devices in hazardous locations shall be suitable for Class I, Division 1, Group D areas as indicated on the drawings.

2.6.2 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and the contract drawings. Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light. Strobe flash rate shall be between 1 to 3 flashes per second and a minimum of 110 candela. Appliances used in hazardous locations shall have a minimum 75 candela. Strobe shall be semi-flush mounted. All visual notification appliances of the same type shall be synchronized.

2.6.3 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. Units shall be factory assembled. Any other audible notification appliance employed in the fire alarm systems shall be approved by the Contracting Officer.

2.7 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.7.1 Conduit

Conduit and fittings shall comply with NFPA 70, UL 6, UL 1242, and UL 797.

2.7.2 Wiring

Wiring shall conform to NFPA 70. Wiring for 120 Vac power shall be No. 12 AWG minimum. The SLC wiring shall be copper cable in accordance with the manufacturers requirements. Wiring for fire alarm dc circuits shall be No. 14 AWG minimum. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except that rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to signaling line circuits, initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited.

2.7.3 Special Tools and Spare Parts

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer. Two spare fuses of each type and size required shall be furnished. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Spare fuses shall be mounted in the fire alarm panel.

2.8 TRANSMITTERS

2.8.1 Telephonic Reporting System

Transmitters shall be compatible with existing receiving equipment at the Supervising Station and shall comply with applicable requirements of UL 632. Transmitter shall respond to the actuation of the fire alarm control panel. Wiring shall be extended to the indicated telephone terminating location and connected to specific twisted pair cable identified by the COR in the field.

2.9 POWER EXTENDER PANELS

Power extender panel shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a semi-flush mounted steel cabinet with hinged door and cylinder lock. The extender panel(s) shall have the necessary components and equipment required to provide a minimum of two (2) supervised, Class A, Style Z, notification appliance circuits. Each appliance circuit shall be rated for 3 amperes at 24 volts DC. Primary power for the panel shall be 6.5 amperes at 120 volts AC. Standby power shall be same as fire alarm system and charger shall be housed integrally within the cabinet. The extender panels shall be activated and supervised from a Class A, Style Z notification circuit.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as shown, and in accordance with NFPA 70 and NFPA 72, and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until construction is essentially complete and the building has been thoroughly cleaned. Devices installed in hazardous locations shall be suitable for Class I, Division 1, Group D areas as indicated on the

drawings.

3.1.1 Power Supply for the System

A single dedicated circuit connection for supplying power from a branch circuit to each building fire alarm system shall be provided. The power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked in red with the words "FIRE ALARM CIRCUIT CONTROL".

3.1.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall be broken and not twisted around the terminal. Circuit conductors entering or leaving any mounting box, outlet box enclosure, or cabinet shall be connected to screw terminals with each terminal and conductor marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors in the system is prohibited. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

3.1.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 300 mm nor more than 2000 mm above the finished floor. Manually operable controls shall be between 900 and 1100 mm above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

3.1.4 Detectors

Detectors shall be located and installed in accordance with NFPA 72. Detectors shall be connected into signal line circuits or initiating device circuits as indicated on the drawings. Detectors shall be at least 300 mm from any part of any lighting fixture. Detectors shall be located at least 900 mm from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in open space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 900 mm, sway bracing shall be provided.

3.1.5 Notification Appliances

Visual and audio/visual notification appliances shall be mounted 2000 mm from the bottom of the device to the finished floor or 150 mm below the ceiling, whichever is lower. Audible notification appliances shall be mounted 2300 mm from the top of the device to the finished floor or 150 mm below the ceiling, whichever is lower.

3.1.6 Annunciator Equipment

Annunciator equipment shall be mounted where indicated on the drawings.

3.1.7 Addressable Initiating Device Circuits Module

The initiating device circuits module shall be used to connect supervised conventional initiating devices (water flow switches, water pressure switches, manual fire alarm stations, high/low air pressure switches, and tamper switches). The module shall mount in an electrical box adjacent to or connected to the device it is monitoring and shall be capable of Style B supervised wiring to the initiating device. In order to maintain proper supervision, there shall be no T-taps allowed on style B lines. Addressable initiating device circuits modules shall monitor only one initiating device each. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform supervisory and alarm functions as specified in Section 13930A WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION and Section 13920A FIRE PUMPS, as indicated on the drawings and as specified herein.

3.1.8 Addressable Control Module

Addressable and control modules shall be installed in the outlet box or adjacent to the device they are controlling. All interconnecting wires shall be supervised unless an open circuit or short circuit abnormal condition does not affect the required operation of the fire alarm system. If control modules are used as interfaces to other systems, such as HVAC or elevator control, they shall be within the control panel or immediately adjacent to it. Control modules that control a group of notification appliances shall be adjacent to the first notification appliance in the notification appliance circuits. Control modules that connect to devices shall supervise the notification appliance circuits. Control modules that connect to auxiliary systems or interface with other systems (non-life safety systems) and where not required by NFPA 72, shall not require the secondary circuits to be supervised.

3.2 OVERVOLTAGE AND SURGE PROTECTION

3.2.1 Power Line Surge Protection

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line-to-neutral) and 350 Volt ac (neutral-to-ground).

3.2.2 Low Voltage DC Circuits Surge Protection

All IDC, NAC, and communication cables/conductors, except fiber optics, shall have surge protection installed at each point where it exits or enters a building and as indicated on the drawings. Equipment shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. The surge protector shall be rated to protect the 24 Volt dc equipment. The maximum dc clamping voltages shall be 36 V (line-to-ground) and 72 Volt dc (line-to-line).

3.2.3 Signal Line Circuit Surge Protection

All SLC cables/conductors, except fiber optics, shall have surge

protection/isolation circuits installed at each point where it exits or enters a building. The circuit shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. The surge protector/isolator shall be rated to protect the equipment.

3.3 GROUNDING

Grounding shall be provided by connecting to building ground system.

3.4 SUPERVISING STATION PROVISIONS

The supervising equipment is existing and consists of the following brand and model: Supervising station control panel by Chemetron.

3.5 TESTING

The Contractor shall notify the Contracting Officer at least 15 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise tests. The Contractor shall furnish instruments and personnel required for the tests.

3.5.1 Preliminary Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance, when required. Tests shall include the meggering of system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional. After completing the preliminary testing the Contractor shall complete and submit the NFPA 72, Certificate of Completion.

3.5.2 Acceptance Test

Acceptance testing shall not be performed until the Contractor has completed and submitted the Certificate of Completion. Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that previous deficiencies have been corrected. The Contractor shall complete and submit the NFPA 72, Inspection and Testing Form. The test shall include all requirements of NFPA 72 and the following:

- a. Test of each function of the control panel.
- b. Test of each circuit in both trouble and normal modes.
- c. Tests of each alarm initiating devices in both normal and trouble conditions.
- d. Tests of each control circuit and device.
- e. Tests of each alarm notification appliance.
- f. Tests of the battery charger and batteries.

- g. Complete operational tests under emergency power supply.
- h. Visual inspection of wiring connections.
- i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.
- j. Ground fault
- k. Short circuit faults
- l. Stray voltage
- m. Loop resistance

3.6 TRAINING

Training course shall be provided for the operations and maintenance staff. The course shall be conducted in the building where the system is installed or as designated by the Contracting Officer. The training period for systems operation shall consist of 1 training day (8 hours) and shall start after the system is functionally completed but prior to final acceptance tests. The training period for systems maintenance shall consist of 2 training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover items contained in the operating and maintenance instructions.

-- End of Section --

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SECTION 13920A

FIRE PUMPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 183	(1998) Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	(2001b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(2001) Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service or Both
ASTM A 449	(2000) Quenched and Tempered Steel Bolts and Studs
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 795	(2000) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 135M	(1996) Seamless Brass Tube (Metric)
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75M	(1999) Seamless Copper Tube (Metric)
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM C 533	(1995; R 2001) Calcium Silicate Block and Pipe Thermal Insulation
ASTM D 2000	(1999) Rubber Products in Automotive Applications
ASTM D 3308	(2001) PTFE Resin Skived Tape

ASTM F 436M (1993; R 2000) Hardened Steel Washers
(Metric)

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300 (1999) Hypochlorites

AWWA B301 (1999) Liquid Chlorine

AWWA C104 (1995) Cement-Mortar Lining for
Ductile-Iron Pipe and Fittings for Water

AWWA C110 (1998) Ductile-Iron and Gray-Iron
Fittings, 3 In. Through 48 In. (76 mm
through 1219 mm), for Water

AWWA C111 (2000) Rubber-Gasket Joints for
Ductile-Iron Pressure Pipe and Fittings

AWWA C151 (2002) Ductile-Iron Pipe, Centrifugally
Cast, for Water

AWWA C606 (1997) Grooved and Shouldered Joints

AWWA EWW (1999) Standard Methods for the
Examination of Water and Wastewater

AWWA M20 (1973) Manual: Water Chlorination
Principles and Practices

ASME INTERNATIONAL (ASME)

ASME B16.11 (2002) Forged Fittings, Socket-Welding and
Threaded

ASME B16.18 (2002) Cast Copper Alloy Solder Joint
Pressure Fittings

ASME B16.21 (1992) Nonmetallic Flat Gaskets for Pipe
Flanges

ASME B16.22 (2002) Wrought Copper and Copper Alloy
Solder Joint Pressure Fittings

ASME B16.26 (1988) Cast Copper Alloy Fittings for
Flared Copper Tubes

ASME B16.3 (1998) Malleable Iron Threaded Fittings

ASME B16.39 (1998) Malleable Iron Threaded Pipe Unions
Classes 150, 250, and 300

ASME B16.5 (1996; B16.5a) Pipe Flanges and Flanged
Fittings NPS 1/2 thru NPS 24

ASME B16.9 (2001) Factory-Made Wrought Steel
Buttwelding Fittings

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(2003) Approval Guide Fire Protection
FM P7825b	(2003) Approval Guide Electrical Equipment

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(2002) Installation of Sprinkler Systems
NFPA 20	(2003) Installation of Stationary Pumps
NFPA 24	(2002) Private Fire Service Mains
NFPA 37	(2002) Stationary Combustion Engines and Gas Turbines
NFPA 70	(2002) National Electrical Code
NFPA 72	(2002) National Fire Alarm Code
NFPA 1963	(1998) Fire Hose Connections

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES
(NICET)

NICET 1014-7	(2003) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout
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UNDERWRITERS LABORATORIES (UL)

UL 1247	(1995; Rev thru May 1997) Diesel Engines for Driving Centrifugal Fire Pumps
UL 142	(1993; Rev Jul 1998) Steel Aboveground Tanks for Flammable and Combustible Liquids
UL 448	((1994; Rev thru May 1999) Pumps for Fire-Protection Service
UL 80	(1996) Steel Inside Tanks for Oil-Burner Fuel
UL Fire Prot Dir	(2004) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

Provide fire pump and associated equipment complete and ready for operation. Equipment, materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in

accordance with NFPA 20, NFPA 70, and NFPA 72, except as modified herein. Devices and equipment for fire protection service shall be UL Fire Prot Dir listed or FM P7825a or FM P7825b approved. In the NFPA standards referenced herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.3 SEQUENCE OF OPERATION

1.3.1 Fire Pump

The fire pump shall automatically operate when the pressure drops as indicated on the drawings. The pump shall continue to run until shutdown manually.

1.3.1.1 Pressure Maintenance Pump

Pressure maintenance pump shall operate when the system pressure drops as indicated on the drawings. Pump shall automatically stop at the pressure indicated on the drawings and after the pump has operated for the minimum pump run time specified herein.

1.3.2 Safety Requirements

Coupling, rotating parts, gears, projecting equipment, etc. shall be fully enclosed or properly guarded so as to prevent possible injury to persons that come in close proximity of the equipment. The Contractor shall conduct testing of the fire pumps in a safe manner and ensure that all equipment is safely secured. Hoses and nozzles used to conduct flow tests shall be in excellent condition and shall be safely anchored and secured to prevent any misdirection of the hose streams.

1.4 COORDINATION OF TRADES

Tank supports, piping offsets, fittings, and any other accessories required shall be furnished as specified to provide a complete installation and to eliminate interference with other construction.

1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed with protection from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall be either capped or plugged until installed.

1.6 FIELD MEASUREMENTS

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.7 SUBMITTALS

Indicate submittal classification in the blank space following the name of the item requiring the submittal by using "G" when the submittal requires Government approval. Submittals not classified as "G" will show on the submittal register as "Information Only". For submittals requiring Government approval on Army projects, a code of up to three characters

within the submittal tags may be used following the "G" designation to indicate the approving authority. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Requirements; G

Three copies of the Fire Pump Installation Drawings consisting of a detailed plan view, detailed elevations and sections of the pump room, equipment and piping, drawn to a scale of not less than 1:20. Drawings shall indicate equipment, piping, and associated pump equipment to scale. All clearance, such as those between piping and equipment; between equipment and walls, ceiling and floors; and for electrical working distance clearance around all electrical equipment shall be indicated. Drawings shall include a legend identifying all symbols, nomenclatures, and abbreviations. Drawings shall indicate a complete piping and equipment layout including elevations and/or section views of the following:

- a. Fire pumps, controllers, piping, valves, and associated equipment.
- b. Sensing line for each pump including the pressure maintenance pump.
- c. Engine fuel system for diesel driven pumps.
- d. Engine cooling system for diesel driven pumps.
- e. Pipe hangers and sway bracing including support for diesel muffler and exhaust piping.
- f. Restraint of underground water main at entry-point to the building including details of pipe clamps, tie rods, mechanical retainer glands, and thrust blocks.
- g. A one-line schematic diagram indicating layout and sizes of all piping, devices, valves and fittings.
- h. A complete point-to-point connection drawing of the pump power, control and alarm systems, as well as interior wiring schematics of each controller.

As-Built Drawings; G

As-built drawings, no later than 14 days after completion of the Final Tests. The Fire Pump Installation Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

SD-03 Product Data

Fire Pump Installation Related Submittals; G

A list of the Fire Pump Installation Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist and the Manufacturer's Representative.

Installation Requirements; G

Manufacturer's catalog data included with the Fire Pump Installation Drawings for each separate piece of equipment proposed for use in the system. Catalog data shall indicate the name of the manufacturer of each item of equipment, with data annotated to indicate model to be provided. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided. Catalog data for material and equipment shall include, but not be limited to, the following:

- a. Fire pumps, drivers and controllers including manufacturer's certified shop test characteristic curve for each pump. Shop test curve may be submitted after approval of catalog data but shall be submitted prior to the final tests.
- b. Pressure maintenance pump and controller.
- c. Piping components.
- d. Valves, including gate, check, globe and relief valves.
- e. Gauges.
- f. Hose valve manifold test header and hose valves.
- g. Flow meter.
- h. Restrictive orifice union.
- i. Associated devices and equipment.

Spare Parts; G

Spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

Preliminary Test; G

Proposed procedures for Preliminary Tests, at least 14 days prior to the proposed start of the tests.

Proposed date and time to begin Preliminary Tests, submitted with the Preliminary Tests Procedures.

System Diagrams; G

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment, piping, and storage units, and typed condensed sequence of operation, wiring and control diagrams, and operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under

glass or laminated plastic. After approval, these items shall be posted where directed.

Fire Protection Specialist; G

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the fire pump installation drawings.

Manufacturer's Representative; G

The name and documentation of certification of the proposed Manufacturer's Representative, concurrent with submittal of the Fire Protection Specialist Qualifications.

Field Training; G

Proposed schedule for field training submitted at least 14 days prior to the start of related training.

Final Acceptance Test; G

Proposed date and time to begin Final Acceptance Test, submitted with the Final Acceptance Test Procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

Proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests.

SD-06 Test Reports

Preliminary Test; G

Three copies of the completed Preliminary Tests Reports, no later than 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist and the Manufacturer's Representative.

Final Acceptance Test; G

Three copies of the completed Final Acceptance Tests Reports, no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist and the Manufacturer's Representative. Test reports in booklet form (each copy furnished in a properly labeled three ring binder) showing all field tests and measurements taken during the preliminary and final testing, and documentation that proves compliance with the specified performance criteria, upon completion of the installation and final testing of the installed system. Each test report shall indicate the final position of the controls and pressure switches. The test reports shall include the description of the hydrostatic test conducted on the piping and flushing of the suction and

discharge piping. A copy of the manufacturer's certified pump curve for each fire pump shall be included in the report.

SD-07 Certificates

Qualifications of Installer; G

Fire Protection Specialist; G

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the fire pump installation is in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

SD-10 Operation and Maintenance Data

Fire Pumps; G

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment.

1.8 SPRINKLER SYSTEM INSTALLER

Work specified in this section shall be performed by the Sprinkler System Installer. The Sprinkler System Installer shall be regularly engaged in the installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.9 FIRE PROTECTION SPECIALIST

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level III Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.10 MANUFACTURER'S REPRESENTATIVE

Work specified in this section shall be performed under the supervision of and certified by a representative of the fire pump manufacturer. The Manufacturer's Representative shall be regularly engaged in the installation of the type and complexity of fire pump(s) specified in the Contract documents, and shall have served in a similar capacity for at

least three systems that have performed in the manner intended for a period of not less than 6 months.

1.11 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number. Pumps and motors shall have standard nameplates securely affixed in a conspicuous place and easy to read. Fire pump shall have nameplates and markings in accordance with UL 448. Diesel driver shall have nameplate and markings in accordance with UL 1247. Electric motor nameplates shall provide the minimum information required by NFPA 70, Section 430-7.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.4 UNDERGROUND PIPING COMPONENTS

2.4.1 Pipe and Fittings

Underground piping and piping under the building slab shall be ductile iron with a rated working pressure of 1207 kPa conforming to AWWA C151, with cement mortar lining conforming to AWWA C104. Piping more than 1500 mm outside the building walls shall comply with Section 02510A WATER DISTRIBUTION SYSTEM. Piping shall be polyethylene encased.

2.4.2 Fittings and Gaskets

Fittings shall be ductile iron conforming to AWWA C110. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA C111.

2.4.3 Buried Utility Warning and Identification Tape

Detectable aluminum foil plastic-backed tape or detectable magnetic plastic

tape manufactured specifically for warning and identification of buried piping shall be provided for all buried piping. Tape shall be detectable by an electronic detection instrument. Tape shall be color-coded for the utility involved and imprinted in bold black letters continuously and repeatedly over the entire tape length. Warning and identification shall be "CAUTION BURIED WATER PIPING BELOW" or similar wording. Code and lettering shall be permanent and unaffected by moisture and other substances contained in the trench backfill material. Tape shall be buried at a depth of 300 mm below the top surface of earth or the top surface of the subgrade under pavement.

2.5 ABOVEGROUND PIPING COMPONENTS

2.5.1 Pipe Sizes 65 mm and Larger

2.5.1.1 Pipe

Piping shall be ASTM A 795, Weight Class STD (Standard), Schedule 40 (except for Schedule 30 for pipe sizes 200 mm and greater in diameter), Type E or Type S, Grade A; hot-dipped galvanized steel pipe. Steel pipe shall be joined by means of flanges welded to the pipe or mechanical grooved joints only. Piping shall not be jointed by welding or weld fittings. Suction piping shall be galvanized on the inside per NFPA 20.

2.5.1.2 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.5.1.3 Flanges

Flanges shall be ASME B16.5, Class 150 flanges. Flanges shall be provided at valves, connections to equipment, and where indicated.

2.5.1.4 Gaskets

Gaskets shall be AWWA C111, cloth inserted red rubber gaskets.

2.5.1.5 Bolts

Bolts shall be ASTM A 449, Type 1. Bolts shall extend no less than three full threads beyond the nut with bolts tightened to the required torque.

2.5.1.6 Nuts

Nuts shall be ASTM A 193/A 193M, Grade 5.

2.5.1.7 Washers

Washers shall meet the requirements of ASTM F 436M. Flat circular washers shall be provided under all bolt heads and nuts.

2.5.2 Piping Sizes 50 mm and Smaller

2.5.2.1 Steel Pipe

Steel piping shall be ASTM A 795, Weight Class STD (Standard), Schedule 40, Type E or Type S, Grade A, zinc-coated steel pipe with threaded end connections. Fittings shall be ASME B16.39, Class 150, zinc-coated threaded fittings. Unions shall be ASME B16.39, Class 150, zinc-coated unions.

2.5.3 Pipe Hangers and Supports

Pipe hangers and support shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b and shall be the adjustable type. Finish of rods, nuts, washers, hangers, and supports shall be zinc-plated after fabrication.

2.5.4 Valves

Valves shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire protection service. Valves shall have flange or threaded end connections.

2.5.4.1 Gate Valves and Control Valves

Gate valves and control valves shall be outside screw and yoke (O.S.&Y.) type which open by counterclockwise rotation. Butterfly-type control valves are not permitted.

2.5.4.2 Tamper Switch

The suction control valves, the discharge control valves, valves to test header and flow meter, and the by-pass control valves shall be equipped with valve tamper switches for monitoring by the fire alarm system.

2.5.4.3 Check Valve

Check valve shall be clear open, swing type check valve with flange or threaded inspection plate.

2.5.4.4 Relief Valve

Relief valve shall be spring operated type conforming to NFPA 20. A means of detecting water motion in the relief lines shall be provided where the discharge is not visible within the pump house.

2.5.4.5 Circulating Relief Valve

An adjustable circulating relief valve shall be provided for each fire pump in accordance with NFPA 20.

2.6 FIRE PUMP

Fire pump shall be diesel engine driven. Each pump capacity shall be rated as indicated on the drawings. Fire pump shall furnish not less than 150 percent of rated flow capacity at not less than 65 percent of rated net pressure. Pump shall be centrifugal horizontal split case fire pump. Horizontal pump shall be equipped with automatic air release devices. The maximum rated pump speed shall be 2100 rpm when driving the pump at rated capacity. Pump shall conform to the requirements of UL 448. Fire pump

discharge and suction gauges shall be oil-filled type.

2.7 DIESEL ENGINE DRIVER

Diesel engine driver shall conform to the requirements of UL 1247 and shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire pump service. Driver shall be of the make recommended by the pump manufacturer. The engine shall be closed circuit, liquid-cooled with raw water heat exchanger. Diesel engine shall be electric start type taking current from 2 battery units. Engine shall be equipped with a fuel in-line filter-water separator. Engine conditions shall be monitored with engine instrumentation panel that has a tachometer, hour meter, fuel pressure gauge, lubricating oil pressure gauge, water temperature gauge, and ammeter gauge. Engine shall be connected to horizontal-shaft pump by flexible couplings. An engine jacket water heater shall be provided to maintain a temperature of 49 degrees C in accordance with NFPA 20.

2.7.1 Engine Capacity

Engine shall have adequate wattage to drive the pump at all conditions of speed and load over the full range of the pump performance curve. The wattage rating of the engine driver shall be as recommended by the pump manufacturer and shall be derated for temperature and elevation in accordance with NFPA 20. Ambient temperature at the pump location shall be 32 degrees C. Site elevation shall at mean sea level (MSL).

2.7.2 Exhaust System External to Engine

Exhaust system shall comply with the requirements of NFPA 20 and NFPA 37. An exhaust muffler shall be provided for each diesel engine driver to reduce noise levels less than 95 dBA. A flexible connector with flange connections shall be provided at the engine. Flexible sections shall be stainless steel suitable for diesel-engines exhaust gas at 538 degrees C.

2.7.2.1 Steel Pipe and Fittings

ASTM A 53/A 53M, Schedule 40, black steel, welding end connections. ASME B16.9 or ASME B16.11 welding fittings shall be of the same material and weight as the piping.

2.7.2.2 Flanges

ASME B16.5, Class 300. Flanges shall be provided at connections to diesel engines, exhaust mufflers, and flexible connections. Gaskets shall be ASME B16.21, composition ring, 1.5875 mm. ASTM A 193/A 193M, Grade B8 bolts and ASTM A 194/A 194M, Grade 8 nuts shall be provided.

2.7.2.3 Piping Insulation

The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Products containing asbestos will not be permitted. Exhaust piping system including the muffler shall be insulated with ASTM C 533 calcium silicate insulation, minimum of 75 mm. Insulation shall be secured with not less than 9.525 mm width Type 304 stainless steel bands spaced not more than 200 mm on center. An aluminum jacket encasing the insulation shall be provided. The aluminum jacket shall have a minimum thickness of 0.406 mm, a factory-applied polyethylene and kraft paper moisture barrier on the inside surface. The jacket shall be secured with not less than 13 mm wide stainless steel bands, spaced not

less than 200 mm on centers. Longitudinal and circumferential seams of the jacket shall be lapped not less than 75 mm. Jackets on horizontal line shall be installed so that the longitudinal seams are on the bottom side of the pipe. The seams of the jacket for the vertical lines shall be placed on the off-weather side of the pipe. On vertical lines, the circumferential seams of the jacket shall overlap so the lower edge of each jacket overlaps the upper edge of the jacket below.

2.8 FIRE PUMP CONTROLLER

Controller shall be the automatic type and UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire pump service. **Pump shall be arranged for automatic start and manual push-button stop.** Controllers shall be completely terminally wired, ready for field connections, and mounted in a NEMA Type 4X watertight and dust tight enclosure arranged so that controller current carrying parts will not be less than 300 mm above the floor. **The controller enclosure shall be painted in accordance with Section 09900 PAINTS AND COATINGS for exterior stainless steel surfaces.** Controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments, **automatic starting relay actuated from normally closed contacts, visual alarm lamps and supervisory power light.** The controller shall be factory-equipped with a heater operated by thermostat to prevent moisture in the cabinet.

2.8.1 Controller for Diesel Engine Driven Fire Pump

Controller shall be equipped with two battery chargers; two ammeters; two voltmeters, one for each set of batteries. Controller shall automatically alternate the battery sets for starting the pumps. Controller shall be equipped with the following supervisory alarm functions:

- a. Engine Trouble (individually monitored)
 - (1) Engine overspeed
 - (2) Low Oil Pressure
 - (3) High Water Temperature
 - (4) Engine Failure to Start
 - (5) Battery
 - (6) Battery Charger/AC Power Failure
- b. Main Switch Mis-set
- c. Pump Running
- d. Pump Room Trouble (individually monitored): Low Fuel

Provide remote supervision as required by NFPA 20, in accordance with NFPA 72 under Section 13851A FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE. Alarms shall be individually displayed in front of panel by lighting of visual lamps, except that individual lamps are not required for pump running and main switch mis-set. Controller shall be equipped with a 7-day electric pressure recorder with 24-hour back-up mounted inside the controller. The pressure recorder shall provide a readout of the system pressure from 0 to 207 Pa, time, and date. The controller shall be

equipped with an audible alarm which will activate upon any engine trouble or pump room trouble alarm condition and alarm silence switch. Controller shall be equipped with terminals for field connection of a remote alarm for main switch mis-set, pump running, engine trouble and pump room trouble; and terminals for remote start. When engine emergency overspeed device operates, the controller shall cause the engine to shut down without time delay and lock out until manually reset.

2.9 BATTERIES

Batteries for diesel engine driver shall be sealed lead calcium batteries. Batteries shall be mounted in a steel rack with non-corrosive, non-conductive base, not less than 300 mm above the floor.

2.10 PRESSURE SENSING LINE

A completely separate pressure sensing line shall be provided for each fire pump and for the jockey pump. The sensing line shall be arranged in accordance with Figure A-10.5.2.1 of NFPA 20. The sensing line shall be 15 mm H58 brass tubing complying with ASTM B 135M. The sensing line shall be equipped with two restrictive orifice unions each. Restricted orifice unions shall be ground-face unions with brass restricted diaphragms drilled for a 2.4 mm. Restricted orifice unions shall be mounted in the horizontal position, not less than 1.5 m apart on the sensing line. Two test connections shall be provided for each sensing line. Test connections shall consist of two brass 15 mm globe valves and 8 mm gauge connection tee arranged per NFPA 20. One of the test connections shall be equipped with a 0 to 1380 kPa water oil-filled gauge. Sensing line shall be connected to the pump discharge piping between the discharge piping control valve and the check valve.

2.11 PRESSURE MAINTENANCE PUMP

Pressure maintenance pump shall be electric motor driven, vertical shaft, turbine type with a rated discharge as indicated on the drawings. Pump shall draft from the suction supply side of the suction pipe gate valve of the fire pump and shall discharge into the system at the downstream side of the pump discharge gate valve. An approved indicating gate valve of the outside screw and yoke (O.S.&Y.) type shall be provided in the maintenance pump discharge and suction piping. Oil-filled water pressure gauge and approved check valve in the maintenance pump discharge piping shall be provided. Check valve shall be swing type with removable inspection plate.

A regenerative turbine type pump with infinite shut-off pressure shall not be allowed.

2.11.1 Pressure Maintenance Pump Controller

Pressure maintenance pump controller shall be arranged for automatic and manual starting and stopping and equipped with a "manual-off-automatic" switch. The controller shall be completely prewired, ready for field connections, and wall-mounted in a NEMA Type 4X enclosure. The controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments for automatic starting and stopping. A sensing line shall be provided connected to the pressure maintenance pump discharge piping between the control valve and the check valve. The sensing line shall conform to paragraph, PRESSURE SENSING LINE. The sensing line shall be completely separate from the fire pump sensing lines. An adjustable run timer shall be provided to prevent frequent starting and stopping of the pump motor. The run timer shall be

set for 2 minutes. The enclosure shall be painted in accordance with Section 09900 PAINTS AND COATINGS for exterior stainless steel surfaces.

2.12 DIESEL FUEL SYSTEM EXTERNAL TO ENGINE

Fuel system shall be provided that meets all requirements and advisory provisions of NFPA 20 and NFPA 37. The fuel tank vent piping shall be equipped with screened weatherproof vent cap. Vents shall be extended to the outside. Each tank shall be equipped with a fuel level gauge. Flexible bronze or stainless steel piping connectors with single braid shall be provided at each piping connection to the diesel engine. Supply, return, and fill piping shall be steel piping, except supply and return piping may be copper tubing. Fuel lines shall be protected against mechanical damage. Fill line shall be equipped with 16 mesh removable wire screen. Fill lines shall be extended to the exterior. A weatherproof tank gauge shall be mounted on the exterior wall near each fill line for each tank. The fill cap shall be able to be locked by padlock. The engine supply (suction) connection shall be located on the side of the fuel tank so that 5 percent of the tank volume provides a sump volume not useable by the engine. The elevation of the fuel tank shall be such that the inlet of the fuel supply line is located so that its opening is no lower than the level of the engine fuel transfer pump. The bottom of the tank shall be pitched 21 mm per meter to the side opposite the suction inlet connection, and to an accessible 25 mm plugged globe drain valve.

2.12.1 Steel Pipe

ASTM A 53/A 53M, hot-dipped zinc-coated, Schedule 40, threaded connections. Fittings shall be ASME B16.3, zinc-coated, threaded malleable iron fittings. Unions shall be ASME B16.39 zinc-coated, threaded unions.

2.12.2 Copper Tubing

ASTM B 88M, Type K, soft annealed, with ASME B16.26 flared fittings.

2.12.3 Diesel Fuel Tank

UL 80 or UL 142 for aboveground tanks. Tank shall be double wall.

2.12.4 Valves

An indicating and lockable ball valve shall be provided in the supply line adjacent to the tank suction inlet connection. A check valve shall be provided in fuel return line. Valves shall be suitable for oil service. Valves shall have union end connections or threaded end connections.

- a. Globe valve: MSS SP-80 Class 125
- b. Check valve: MSS SP-80, Class 125, swing check
- c. Ball valve: Full port design, copper alloy body, 2-position lever handle.

2.13 JOINTS AND FITTINGS FOR COPPER TUBE

Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B 75M. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B 62. Brass or

bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used. Grooved mechanical joints and fittings shall be designed for not less than 862 kPa service and shall be the product of the same manufacturer. Grooved fitting and mechanical coupling housing shall be ductile iron conforming to ASTM A 536. Gaskets for use in grooved joints shall be molded synthetic polymer of pressure responsive design and shall conform to ASTM D 2000 for circulating medium up to 110 degrees C. Grooved joints shall conform to AWWA C606 Coupling nuts and bolts for use in grooved joints shall be steel and shall conform to ASTM A 183.

2.14 PUMP BASE PLATE AND PAD

A common base plate shall be provided for each horizontal-shaft fire pump for mounting pump and driver unit. The base plate shall be constructed of cast iron with raised lip tapped for drainage or welded steel shapes with suitable drainage. Each base plate for the horizontal fire pumps shall be provided with a 25 mm galvanized steel drain line piped to the nearest floor drain. Pump units and bases shall be mounted on a raised 150 mm reinforced concrete pad that is an integral part of the reinforced concrete floor.

2.15 HOSE VALVE MANIFOLD TEST HEADER

Hose valve test header shall be connected by ASME B16.5, Class 150 flange inlet connection. The test header shall be the linear manifold type. The rosebud type is not permitted. Hose valves shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b bronze hose gate valves with 65 mm American National Fire Hose Connection Screw Standard Threads (NH) per NFPA 1963. The number of valves shall be per NFPA 20. Each hose valve shall be equipped with a cap and chain, and located no more than 900 mm and no less than 600 mm above grade.

2.16 FIRE DEPARTMENT CONNECTION

Fire department connection shall be projecting type with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a polished brass finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 65 mm diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

2.17 FLOW METER

Meter shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825bas flow meters for fire pump installation with direct flow readout device. Flow meter shall be capable of metering any waterflow quantities between 50 percent and 150 percent of the rated flow of the pumps. The flow meter shall be arranged in accordance with Figure A-5.19.1.2 of NFPA 20. The meter throttle valve and the meter control valves shall be O.S.&Y. valves. Automatic air release shall be provided if flow meter test discharge is piped to the pump suction and forms a closed-loop meter arrangement as defined in Figure A-5.19.1.2 of NFPA 20.

2.18 PIPE SLEEVE

A pipe sleeve shall be provided at each location where piping passes through walls, ceilings, roofs, and floors, including pipe entering buildings from the exterior. Sleeves shall be grouted in position during

construction. Sleeve shall be of sufficient length to pass through the entire thickness of the wall, ceilings, roofs and floors. The space between the exterior surface of the pipe and the interior surface of the sleeve shall be firmly packed with mineral wool insulation and caulk at both ends with plastic waterproof cement which will dry to a firm but pliable mass, or with a segmented elastomeric seal. Where pipes pass through fire walls or fire floors, a fire seal shall be provided between the pipe and the sleeve in accordance with Section 07840A FIRESTOPPING. Sleeves in masonry and concrete walls, ceiling, roofs and floors shall be hot-dip galvanized steel, ductile-iron, or cast-iron. Other sleeves shall be galvanized steel sheet pipe not less than 4.4 kg per square meter.

2.19 ESCUTCHEON (WALL) PLATES

Escutcheon plates shall be one-piece or split-hinge type metal plates and shall be provided for piping passing through floors, walls, and ceiling in exposed areas. In finished areas, plates shall be polished stainless steel or chromium-plated finish on copper alloy. In unfinished areas, plates shall have painted finish. Plates shall be secured in position.

2.20 DISINFECTING MATERIALS

2.20.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.20.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

PART 3 EXECUTION

3.1 FIRE PUMP INSTALLATION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation the fire pump(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the fire pump installation periodically assure that the installation conforms to the contract requirements. The Fire Protection Specialist shall perform a thorough inspection of the fire pump installation, including visual observation of the pump while running shall be conducted. There shall be no excessive vibration, leaks (oil or water), unusual noises, overheating, or other potential problems. Inspection shall include piping and equipment clearance, access, supports, and guards. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered. The Fire Protection Specialist shall witness the preliminary and final acceptance tests and, after completion of the inspections and a successful final acceptance test, shall sign test results and certify in writing that the installation the fire pump installation is in accordance with the contract requirements.

3.3 INSTALLATION REQUIREMENTS

Installation, workmanship, fabrication, assembly, erection, examination, inspection and testing shall be in accordance NFPA 20, except as modified herein. In addition, the fire pump and engine shall be installed in accordance with the written instructions of the manufacturer.

3.4 PIPE AND FITTINGS

Piping shall be inspected, tested and approved before burying, covering, or concealing. Fittings shall be provided for changes in direction of piping and for all connections. Changes in piping sizes shall be made using tapered reducing pipe fittings. Bushings shall not be used.

3.4.1 Cleaning of Piping

Interior and ends of piping shall be clean and free of any water or foreign material. Piping shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of the piping shall be securely closed so that no water or foreign matter will enter the pipes or fittings. Piping shall be inspected before placing in position.

3.4.2 Protection of Piping Against Earthquake Damage

The system piping shall be protected against damage from earthquakes. Seismic protection shall include flexible and rigid couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required by NFPA 13 for protection of piping against damage from earthquakes. Provide branchline restraint as required by NFPA 13.

3.4.3 Threaded Connections

Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape conforming to ASTM D 3308 and shall be applied to male threads only. Exposed ferrous pipe threads shall be provided with one coat of zinc molybdate primer applied to a minimum of dry film thickness of 0.025 mm.

3.4.4 Pipe Hangers and Supports

Additional hangers and supports shall be provided for concentrated loads in aboveground piping, such as for valves and risers.

3.4.4.1 Vertical Piping

Piping shall be supported at each floor, at not more than 3 meters intervals.

3.4.4.2 Horizontal Piping

Horizontal piping supports shall be spaced as follows:

MAXIMUM SPACING (METERS)

Nominal Pipe Size (mm)	25 and Under	32	40	50	65	80	90	100	125	150+
Copper Tube	1.8	2	2.4							
Steel Pipe	2	2.4	2.7	3	3.3	3.6	3.9	4.2	4.8	5.0

3.4.5 Underground Piping

Installation of underground piping and fittings shall conform to NFPA 24. Joints shall be anchored in accordance with NFPA 24. Concrete thrust block shall be provided at elbow where pipe turns up towards floor, and the pipe riser shall be restrained with steel rods from the elbow to the flange above the floor. After installation per NFPA 24, rods and nuts shall be thoroughly cleaned and coated with asphalt or other corrosion-retard material approved by the Contracting Officer. Minimum depth of cover shall be 900 mm.

3.4.6 Grooved Mechanical Joint

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.5 ELECTRICAL WORK

Electric motor and controls shall be in accordance with NFPA 20 and NFPA 70, unless more stringent requirements are specified herein or are indicated on the drawings. Electrical wiring and associated equipment shall be provided in accordance with NFPA 20 and Section 16415A ELECTRICAL WORK, INTERIOR.

3.6 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09900 PAINTING, GENERAL.

3.7 FLUSHING

The fire pump suction and discharge piping shall be flushed at 120 percent of rated capacity of each pump. Where the pump installation consists of more than one pump, the flushing shall be the total quantity of water flowing when all pumps are discharging at 120 percent of their rated

capacities. The new pumps may be used to attain the required flushing volume. Flushing operations shall continue until water is clear, but not less than 10 minutes. The Contractor shall submit a signed and dated flushing certificate before requesting field testing.

3.8 FIELD TESTS

3.8.1 Hydrostatic Test

Piping shall be hydrostatically tested at 1551 kPa for a period of 2-hours, or at least 345 kPa in excess of the maximum pressure, when the maximum pressure in the system is in excess of 1207 kPa.

3.8.2 Preliminary Test

The Fire Protection Specialist shall take all readings and measurements. The Manufacturer's Representative, a representative of the fire pump controller manufacturer, and a representative of the diesel engine manufacturer (when supplied) shall witness the complete operational testing of the fire pump and drivers. The fire pump controller manufacturer's representative and the diesel engine manufacturer's representative shall each be an experienced technician employed by the respective manufacturers and capable of demonstrating operation of all features of respective components including trouble alarms and operating features. Fire pumps, drivers and equipment shall be thoroughly inspected and tested to insure that the system is correct, complete, and ready for operation. Tests shall ensure that pumps are operating at rated capacity, pressure and speed. Tests shall include manual starting and running to ensure proper operation and to detect leakage or other abnormal conditions, flow testing, automatic start testing, testing of automatic settings, sequence of operation check, test of required accessories; test of pump alarms devices and supervisory signals, test of pump cooling, operational test of relief valves, and test of automatic power transfer, if provided. Pumps shall run without abnormal noise, vibration or heating. If any component or system was found to be defective, inoperative, or not in compliance with the contract requirements during the tests and inspection, the corrections shall be made and the entire preliminary test shall be repeated.

3.8.3 Final Acceptance Test

The Fire Protection Specialist shall take all readings and measurements. The Manufacturer's Representative, the fire pump controller manufacturer's representative, and the diesel engine manufacturer's representative (when supplied) shall also witness for the final tests. The Contractor shall be responsible for repairing any damage caused by hose streams or other aspects of the test. The final acceptance test shall include the following:

3.8.3.1 Flow Tests

Flow tests using the test header, hoses and playpipe nozzles shall be conducted. Flow tests shall be performed at churn (no flow), 75, 100, 125 and 150 percent capacity for each pump and at full capacity of the pump installation. Flow readings shall be taken from each nozzle by means of a calibrated pitot tube with gauge or other approved measuring equipment. Rpm, suction pressure and discharge pressure reading shall be taken as part of each flow test. Voltage and ampere readings shall taken on each phase as part of each flow test for electric-motor driven pumps.

3.8.3.2 Starting Tests

Pumps shall be tested for automatic starting and sequential starting. Setting of the pressure switches shall be tested when pumps are operated by pressure drop. Tests may be performed by operating the test connection on the pressure sensing lines. As a minimum, each pump shall be started automatically 10 times and manually 10 times, in accordance with NFPA 20. Tests of engine-driven pumps shall be divided equally between both set of batteries. The fire pumps shall be operated for a period of at least 10 minutes for each of the starts; except that electric motors over 149 kW shall be operated for at least 15 minutes and shall not be started more than 2 times in 10 hours. Pressure settings that include automatic starting and stopping of the fire pump(s) shall be indicated on an etched plastic placard, attached to the corresponding pump controller.

3.8.3.3 Battery Changeover

Diesel driven fire pumps shall be tested for automatic battery changeover in event of failure of initial battery units.

3.8.3.4 Alarms

All pump alarms, both local and remote, shall be tested. Supervisory alarms for diesel drivers shall be electrically tested for low oil pressure, high engine jacket coolant temperature, shutdown from overspeed, battery failure and battery charger failure.

3.8.3.5 Miscellaneous

Valve tamper switches shall be tested. Pressure recorder operation relief valve settings, valve operations, operation and accuracy of meters and gauges, and other accessory devices shall be verified.

3.8.4 Correction of Deficiencies

If equipment was found to be defective or non-compliant with contract requirements, the Contractor shall performed corrective actions and repeat the tests. Tests shall be conducted and repeated if necessary until the system has been demonstrated to comply with all contract requirements.

3.8.5 Test Equipment

The Contractor shall provide all equipment and instruments necessary to conduct a complete final test, including 65 mm diameter hoses, playpipe nozzles, pitot tube gauges, portable digital tachometer, voltage and ampere meters, and calibrated oil-filled water pressure gauges. The Contractor shall provide all necessary supports to safely secure hoses and nozzles during the test. The Government will furnish water for the tests.

3.8.6 Test Documentation

The Manufacturer's Representative shall supply a copy of the manufacturer's certified curve for each fire pump at the time of the test. The Fire Protection Specialist shall record all test results and plot curve of each pump performance during the test. Complete pump acceptance test data of each fire pump shall be recorded. The pump acceptance test data shall be on forms that give the detail pump information such as that which is indicated in Figure A-11-2.6.3(f) of NFPA 20. All test data records shall be submitted in a three ring binder.

3.9 DISINFECTION

After all system components are installed including pumps, piping, and other associated work, and all hydrostatic test(s) are successfully completed, thoroughly flush the pumps and all piping to be disinfected with potable water until there is no visible sign of dirt or other residue. and hydrostatic test are successfully completed, each portion of the piping specified in this Section system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.10 FIELD TRAINING

The Fire Protection Specialist and the Manufacturer's Representative shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 8 hours of normal working time and shall start after the fire pump installation is functionally complete but prior to the start tests specified herein. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

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PLUMBING, GENERAL PURPOSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

- | | |
|----------|---|
| ARI 1010 | (1994) Self-Contained, Mechanically Refrigerated Drinking-Water Coolers |
| ARI 700 | (1999) Specifications for Fluorocarbon and Other Refrigerants |

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|-----------------|---|
| ASME A112.19.3M | (1987; R 1996) Stainless Steel Plumbing Fixtures (Designed for Residential Use) |
| ANSI Z21.22 | (1999; A 2001) Relief Valves for Hot Water Supply Systems |
| ANSI Z124.5 | (1997) Plastic Toilet (Water Closet) Seats |
| ANSI Z358.1 | (1998) Emergency Eyewash and Shower Equipment |

ASTM INTERNATIONAL (ASTM)

- | | |
|-------------------|---|
| ASTM A 105/A 105M | (2002) Carbon Steel Forgings for Piping Applications |
| ASTM A 193/A 193M | (2001b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service |
| ASTM A 515/A 515M | (2001) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service |
| ASTM A 516/A 516M | (2001) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service |
| ASTM B 152/B 152M | (2000) Copper Sheet, Strip, Plate, and Rolled Bar |
| ASTM B 32 | (2000e1) Solder Metal |

ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM B 42	(2002) Seamless Copper Pipe, Standard Sizes
ASTM B 75M	(1999) Seamless Copper Tube (Metric)
ASTM B 813	(2000e1) Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM C 564	(1997) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 1785	(1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(2000) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2002) Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2002) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(2002) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2665	(2002a) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2672	(1996a) Joints for IPS PVC Pipe Using Solvent Cement
ASTM D 2822	(1991; R 1997e1) Asphalt Roof Cement
ASTM D 2846/D 2846M	(1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D 2855	(1996; R 2002) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3122	(1995; R 2002) Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings
ASTM D 3138	(2002) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure

Piping Components

ASTM D 3308	(2001) PTFE Resin Skived Tape
ASTM D 3311	(1994) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM E 1	(2001) ASTM Thermometers
ASTM F 1760	(2001) Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
ASTM F 409	(2002) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F 437	(1999) Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 438	(2002) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F 439	(2002) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 441/F 441M	(1999e1) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F 442/F 442M	(1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F 493	(1997) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F 891	(2000e1) Coextruded Poly (Vinyl chloride) (PVC) Plastic Pipe with a Cellular Core
AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)	
ASHRAE 34	(2001; Errata 2002) Designation and Safety Classification of Refrigerants
ASHRAE 90.1	(2001; various Errata) Energy Standard for Buildings Except Low-Rise Residential Buildings
AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)	
ASSE 1001	(2002) Atmospheric Type Vacuum Breakers
ASSE 1005	(1999) Water Heater Drain Valves

ASSE 1011	(1993) Hose Connection Vacuum Breakers
ASSE 1012	(2002) Backflow Preventers with Intermediate Atmospheric Vent
ASSE 1013	(1999) Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers
ASSE 1018	(2001) Trap Seal Primer Valves, Water Supply Fed
ASSE 1020	(1998) Pressure Vacuum Breaker Assembly
ASSE 1037	(1990) Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine
AWWA C651	(1999) Disinfecting Water Mains
AWWA C652	(1992) Disinfection of Water Storage Facilities
AWWA EWW	(1999) Standard Methods for the Examination of Water and Wastewater

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS B2.2	(1991) Brazing Procedure and Performance Qualification

ASME INTERNATIONAL (ASME)

ASME A112.1.2	(1991; R 2002) Air Gaps in Plumbing Systems
ASME A112.18.1	(2000) Plumbing Fixture Fittings
ASME A112.19.1M	(1994; R 1999 Enameled Cast Iron Plumbing Fixtures
ASME A112.19.2M	(1998) Vitreous China Plumbing Fixtures
ASME A112.6.1M	(1997; R 2002) Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.6.3	(2000) Floor and Trench Drains
ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose, Inch

ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(2002) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.22	(2002) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.29	(2002) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.5	(1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B31.1	(2001) Power Piping
ASME B31.5	(2001) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(1998a) Pressure Gauges and Gauge Attachments
ASME BPVC SEC VIII D1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPVC SEC IX	(2001) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.134 Respiratory Protection

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015 (1994; R 1995) Copper Tube Handbook

**FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH
(FCCCHR)**

FCCCHR Manual (9th Edition) Manual of Cross-Connection Control

HYDRAULIC INSTITUTE (HI)

HI 1.1-1.5 (1994) Centrifugal Nomenclature

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1 (2003) Accessible and Usable Buildings and Facilities

ICC IPC (2000) International Plumbing Code

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-110	(1996) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(2002) Pipe Hangers and Supports - Selection and Application
MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-72	(1999) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-73	(1991; R 1996) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2002) Installation of Air-Conditioning and Ventilating Systems
----------	--

NSF INTERNATIONAL (NSF)

NSF 14	(2002) Plastics Piping Components and Related Materials
NSF 61	(2001 Addendum 1 - Sep 2001) Drinking Water System Components - Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA-01	(1998) Plastic Pipe in Fire Resistive Construction
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PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201	(1992) Water Hammer Arresters
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SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1508	(1997) Hose Clamp Specifications
-----------	----------------------------------

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-240 (Rev A; Canc. Notice 1) Shower Head, Ball Joint

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 430 Energy Conservation Program for Consumer Products

PL 93-523 (1974; A 1999) Safe Drinking Water Act

UNDERWRITERS LABORATORIES (UL)

UL 174 (1996; Rev thru Oct 1999) Household Electric Storage Tank Water Heaters

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Plumbing System

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operations of each system. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

Electrical Work

Complete electrical schematic lineless or full line interconnection and connection diagram for each piece of mechanical equipment having more than one automatic or manual electrical control device.

SD-03 Product Data

Welding

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

Plumbing Fixture Schedule

Catalog cuts of specified plumbing fixtures, valves, related piping system, and system location where installed.

Vibration-Absorbing Features

Details of vibration-absorbing features, including arrangement, foundation plan, dimensions and specifications.

Plumbing System

Diagrams, instructions, and other sheets proposed for posting. Manufacturer's recommendations for the installation of bell and spigot and hubless joints for cast iron soil pipe.

SD-06 Test Reports

Tests, Flushing and Disinfection

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Test of Backflow Prevention Assemblies.

Certification of proper operation shall be as accomplished in accordance with USAKA/KMR regulations by an individual certified by the USAKA/KMR to perform such tests. If no USAKA/KMR requirement exists, the Contractor shall have the manufacturer's representative test the device, to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation of the tests performed and signed by the individual performing the tests.

SD-07 Certificates

Materials and Equipment

Where materials or equipment are specified to comply with requirements of AGA, ASME, or NSF proof of such compliance shall be included. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

Bolts

Written certification by the bolt manufacturer that the bolts furnished comply with the specified requirements. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

SD-10 Operation and Maintenance Data

Plumbing System

Six copies of the operation manual outlining the step-by-step procedures required for system startup, operation and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of the maintenance manual listing routine maintenance procedures, possible breakdowns and repairs. The manual shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

1.3 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening.

1.4 ELECTRICAL WORK

Motors, motor controllers and motor efficiencies shall conform to the requirements of Section 16415A ELECTRICAL WORK, INTERIOR. Electrical motor-driven equipment specified herein shall be provided complete with motors. Equipment shall be rated at 60 Hz, single phase, ac unless otherwise indicated. Where a motor controller is not provided in a motor-control center on the electrical drawings, a motor controller shall be as indicated. Motor controllers shall be provided complete with properly sized thermal-overload protection in each ungrounded conductor, auxiliary contact, and other equipment, at the specified capacity, and including an allowable service factor.

1.5 PERFORMANCE REQUIREMENTS

1.5.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record.

1.6 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with ICC IPC.

1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF 61, Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen faucets, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF 61, Section 9. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

2.1.1 Pipe Joint Materials

Joints and gasket materials shall conform to the following:

- a. Brazing Material: Brazing material shall conform to AWS A5.8, BCuP-5.
- b. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.
- c. Solder Material: Solder metal shall conform to ASTM B 32.
- d. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, Standard Test 1.
- e. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe, ASTM D 3308.
- f. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D 3138.
- g. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.
- h. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.
- i. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105/A 105M. Blind flange material shall conform to ASTM A 516/A 516M cold service and ASTM A 515/A 515M for hot service. Bolts shall be high

strength or intermediate strength with material conforming to ASTM A 193/A 193M.

- j. Plastic Solvent Cement for Styrene Rubber Plastic Pipe: ASTM D 3122.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

- a. Water Hammer Arrestor: PDI WH 201.
- b. Copper, Sheet and Strip for Building Construction: ASTM B 370.
- c. Asphalt Roof Cement: ASTM D 2822.
- d. Hose Clamps: SAE J1508.
- e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.
- f. Trap Primer: Cast bronze with 12 mm connection. Provide access panel as required.
- g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.
- h. Hypochlorites: AWWA B300.
- i. Liquid Chlorine: AWWA B301.
- j. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.
- k. Thermometers: ASTM E 1. Mercury shall not be used in thermometers.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 65 mm and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 80 mm and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Vacuum Relief Valves	ANSI Z21.22
Water Heater Drain Valves	ASSE 1005
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22

2.3.1 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 20 mm male inlet threads, hexagon shoulder, and 20 mm hose connection. Faucet handle shall be securely attached to stem.

2.3.2 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22. Relief valves for systems where the maximum rate of heat input is less than 59 kW shall have 20 mm minimum inlets, and 20 mm outlets. Relief valves for systems where the maximum rate of heat input is greater than 59 kW shall have 25 mm minimum inlets, and 25 mm outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

2.3.3 Thermostatic Mixing Valves

Mixing valves, thermostatic type, pressure-balanced or combination thermostatic and pressure-balanced shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, corrosion-resisting steel or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 2 degrees C of any setting. Allowable pressure drop across the valve shall be 34.5 kPa.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with ICC IPC. Fixtures for use by the physically handicapped shall be in accordance with ICC A117.1. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 82 degrees C water temperature. Plumbing fixtures shall be as indicated in paragraph PLUMBING FIXTURE SCHEDULE.

2.4.1 Lavatories

Vitreous china lavatories shall be provided with two integral molded lugs on the back-underside of the fixture and drilled for bolting to the wall in a manner similar to the hanger plate.

2.5 BACKFLOW PREVENTERS

Backflow preventers shall be approved and listed by the Foundation For Cross-Connection Control & Hydraulic Research. Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCCHR Manual. Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to ASSE 1013. Hose connection vacuum breakers shall conform to ASSE 1011. Pipe applied atmospheric type vacuum breakers shall conform to ASSE 1001. Pressure vacuum breaker assembly shall conform to ASSE 1020. Air gaps in plumbing systems shall conform to ASME A112.1.2. Backflow preventer for hydroblast equipment shall be reduced principle type backflow preventer.

2.6 DRAINS

2.6.1 Floor and Shower Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer

shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded connection. Between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C 564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.6.3.

2.6.2 Area Drains

Area drains shall be plain pattern with polished stainless steel perforated or slotted grate and bottom outlet. The drain shall be circular or square with a 300 mm nominal overall width or diameter and 250 mm nominal overall depth. Drains shall be cast iron with manufacturer's standard coating. Grate shall be easily lifted out for cleaning. Outlet shall be suitable for inside caulked connection to drain pipe. Drains shall conform to ASME A112.6.3.

2.6.3 Floor Sinks

Floor sinks shall be square, with 300 mm nominal overall width or diameter and 250 mm nominal overall depth. Floor sink shall have an acid-resistant enamel interior finish with cast-iron body, aluminum sediment bucket, and perforated grate of cast iron in industrial areas and stainless steel in finished areas. The outlet pipe size shall be as indicated or of the same size as the connecting pipe.

2.7 TRAPS

Unless otherwise specified, traps shall be plastic per ASTM F 409 or copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.813 mm thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 50 mm. The interior diameter shall be not more than 3.2 mm over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.8 OIL WATER INTERCEPTOR

Provide oil/water interceptor as indicated on the drawing. Interceptor shall be acid resistant coated interior and exterior fabricated steel with air relief by-pass, bronze cleanout plug and visible double wall trap seal, removable combination pressure equalizing/flow diffusing baffle and sediment bucket, horizontal baffle, adjustable oil drawoff and vent connection either side, secured gasketed non-skid secured cover complete with flow control fitting.

2.9 SOLID INTERCEPTOR

Provide solid interceptor as indicated on the drawing. Interceptor shall be acid resistant coated fabricated steel, with removable primary and secondary flow diffusing/intercepting screens, and sediment bucket, with gasketed non-skid cover.

2.10 WATER HEATERS

Water heater types and capacities shall be as indicated. Each water heater shall have replaceable anodes. Each primary water heater shall have controls with an adjustable range that includes 32 to 71 degrees C. Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and standby heat losses shall conform to TABLE III for each type of water heater specified. The only exception is that storage water heaters and hot water storage tanks having more than 2000 liters storage capacity need not meet the standard loss requirement if the tank surface area is insulated to R-12.5 and if a standing light is not used. A factory pre-charged expansion tank shall be installed on the cold water supply to each water heater. Expansion tanks shall be specifically designed for use on potable water systems and shall be rated for 93 degrees C water temperature and 1034 kPa working pressure. The expansion tank size and acceptance volume shall be as indicated.

2.10.1 Automatic Storage Type

Heaters shall be complete with control system, temperature gauge, and pressure gauge, and shall have ASME rated combination pressure and temperature relief valve.

2.10.1.1 Electric Type

Electric type water heaters shall conform to UL 174 with dual heating elements. Each element shall be 4.5 KW. The elements shall be wired so that only one element can operate at a time.

2.11 PUMPS

2.11.1 Sump Pumps

Sump pumps shall be of capacities indicated. The pumps shall be of the automatic, electric motor-driven, submerged type, complete with necessary control equipment and with a split or solid cast-iron or steel cover plate. The pumps shall be direct-connected by an approved flexible coupling to a vertical electric motor having a continuous oiling device or packed bearings sealed against dirt and moisture. Motors shall be totally enclosed, fan-cooled of sizes as indicated and shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 4 enclosure. Each pump shall be fitted with a high-grade thrust bearing mounted above the floor. Each shaft shall have an alignment bearing at each end, and the suction inlet shall be between 75 and 150 mm above the sump bottom. The suction side of each pump shall have a strainer of ample capacity. A float switch assembly, with the switch completely enclosed in a NEMA 250, Type 4 enclosure, shall start and stop each motor at predetermined water levels. Duplex pumps shall be equipped with an automatic alternator to change the lead operation from one pump to the other, and for starting the second pump if the flow exceeds the capacity of the first pump. The discharge line from each pump shall be provided with a union or flange, a nonclog swing check valve, and a stop valve in an accessible location near the pump.

2.11.2 Circulating Pumps

Domestic hot water circulating pumps shall be electrically driven, single-stage, centrifugal, with mechanical seals, suitable for the intended service. Pump capacities, efficiencies, motor sizes, speeds, and impeller types shall be as shown. Pump and motor shall be integrally mounted on a cast-iron or steel subbase or supported by the piping on which it is installed. The shaft shall be one-piece, heat-treated, corrosion-resisting steel with impeller and smooth-surfaced housing of bronze. Motor shall be totally enclosed, fan-cooled and shall have sufficient wattage for the service required. Pump shall conform to HI 1.1-1.5. Each pump motor shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in cover. Pump motors smaller than 746 W (Fractional horsepower pump motors) shall have integral thermal overload protection in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Guards shall shield exposed moving parts.

2.11.3 Flexible Connectors

Flexible connectors shall be provided at the suction and discharge of each pump that is 1 hp or larger. Connectors shall be constructed of neoprene, rubber, or braided bronze, with Class 150 standard flanges. Flexible connectors shall be line size and suitable for the pressure and temperature of the intended service.

2.12 COMPRESSED AIR SYSTEM

2.12.1 Air Compressor

Air compressor unit shall be a factory-packaged assembly, air-cooled, including 3 phase, 460 volt motor controls, switches, wiring, accessories, and motor controllers, in a NEMA 250, Type 4 enclosure. Air compressor shall have manufacturer's name and address, together with trade name, and catalog number on a nameplate securely attached to the equipment. The compressor shall start and stop automatically at upper and lower pressure limits of the system, regulate pressure by constant speed compressor loading and unloading, have a manual-off-automatic switch that when in the manual position, the compressor loads and unloads to meet the demand and, in the automatic position, a time delay relay shall allow the compressor to operate for an adjustable length of time unloaded, then stop the unit. Guards shall shield exposed moving parts. The compressor motor shall be provided with an across-the-line-type magnetic controller, complete with low-voltage release. An intake air filter and silencer shall be provided with the compressor. Aftercooler and moisture separator shall be installed between compressor and air receiver to remove moisture and oil condensate before the air enters the receiver. Aftercooler shall be air-cooled, as indicated. The air shall pass through a sufficient number of tubes to affect cooling. Tubes shall be sized to give maximum heat transfer. Cooling capacity of the aftercooler shall be sized for the total capacity of the compressor. Means shall be provided for draining condensed moisture from the receiver by an automatic float type trap. Capacities of air compressor and receiver shall be as indicated.

2.12.2 Lubricated Compressors

Compressors shall be rotary screw, capable of operating continuously against their designed discharge pressure, and shall operate at a speed not in excess of 24 meters per second. Compressors shall have the capacity and

discharge pressure indicated. Compressors shall be assembled complete on a common subbase. The compressor main bearings shall be either roller or ball. The discharge passage of the high pressure air shall be piped to the air receiver with a copper pipe or tubing. A pressure gauge calibrated to 1.03 MPa and equipped with a gauge cock and pulsation dampener shall be furnished for installation adjacent to pressure switches.

2.12.3 Air Receivers

Receivers shall be designed for 1.38 MPa working pressure. Receivers shall be factory air tested to 1-1/2 times the working pressure. **Receivers shall be equipped with safety relief valves and accessories, including pressure gauges and automatic drains. The air receivers shall be galvanized.** Receivers shall be designed and constructed in accordance with ASME BPVC SEC VIII D1 and shall have the design working pressures specified herein. A display of the ASME seal on the receiver or a certified test report from an approved independent testing laboratory indicating conformance to the ASME Code shall be provided.

2.12.4 Intake Air Supply Filter

Dry type air filter shall be provided having a collection efficiency of 99 percent of particles larger than 10 microns. Filter body and media shall withstand a maximum 862 kPa, capacity as indicated.

2.12.5 Pressure Regulators

The air system shall be provided with the necessary regulator valves to maintain the desired pressure for the installed equipment. Regulators shall be designed for a maximum inlet pressure of 862 kPa and a maximum temperature of 93 degrees C. Regulators shall be single-seated, pilot-operated with valve plug, bronze body and trim or equal, and threaded connections. The regulator valve shall include a pressure gauge and shall be provided with an adjustment screw for adjusting the pressure differential from 0 kPa to 862 kPa. Regulator shall be sized as indicated.

2.12.6 Refrigerated Air Dryer

Provide cycling refrigerated air dryer rated for 424.8 L/s, 460/3/60, 3.5 kw, 1723.7 kPa. Provide prefilter and after filter. Microprocessor controlled with digital display shall indicate dew point temperature, operating mode, total hour meter, percent time loaded, percent current load, refrigeration compressor working, condensate level, time to next drain, maintenance interval status, high pressure, system interruption, diagnostic codes, on/off function key, data selector function key, and drain management key.

2.12.7 Miscellaneous Compressed Air Accessories

2.12.7.1 Spring Loaded Check Valve

Provide 2068 kPa rated, Class 125 spring loaded check valve as indicated on the drawings.

2.12.7.2 Compressed Air Filters

- a. Coalescing Filter: Provide coalescing filter downstream of air-cooled after cooler as indicated on the drawings. Filter shall remove solid particle 3 microns, liquid removal efficiency

of 99 percent, maximum inlet liquid loading of 25,000 ppm w/w and a remaining oil content of 5 aerosols ppm w/w.

- b. Oil Filter: Provide maximum efficiency oil filter downstream of refrigerated air dryer as indicated on the drawing. Filter shall remove solid particle .01 microns, liquid removal efficiency if 99.999 percent, maximum inlet liquid loading of 100 ppm w/w and remaining oil content of .001 aerosols ppm w/w. Provide with differential pressure gauge, liquid level indicator, and external drain adapter. Minimum rated capacity of 368.1 L/s.

2.12.7.3 Breathing Air Purification System and CO Monitor

Contractor to provide breathing air purification system and CO monitor for paint booth, abrasive blast booth, hydro blast room, and metalization booth as indicated on the drawings and as follows:

- b. Personal Air Filter: Air filter will remove particulates from compressed air to satisfy requirements of OSHA 29 CFR 1910.134 (d)(1) for grade D breathing. It shall be rated over 99% efficient and constructed to ASME code requirements for unfired pressure vessels. 861 kPa at 4.1 safety factor.
- c. Carbon Monoxide Monitor: Monitor shall be provided to detect presence of carbon monoxide in the breathing air supply. Monitor will be set at 10 PPM in accordance with OSHA 29 CFR 1910.134(d) (1) and (2). It will be mounted in an electrical enclosure and includes alarm and calibration kit.

2.12.7.4 Quick Disconnect

Provide coupling device with spring loaded shut off valve and a positive locking mechanism as shown on drawings.

2.12.7.5 Solenoid Valve

Provide quarter-turn ball valve with electric operator rated for 4136.9 kPa wog, 120V with CV factor 102.0, and mountable in any position. Provide as shown on drawings and interlock with equipment/booth controls for which it is serving. Coordinate power requirements for all valves whether shown on the drawings or not.

2.12.7.6 Oil Water Separator

Provide oil/water separator as shown on the drawings. The contractor shall pipe condensate discharge from the mechanical separator on the air compressor and the refrigerated air dryer to the oil/water separator. The condensate from the air receiver shall be terminate in a condensate pump and pumped to the oil/water separator. The rated capacity of the oil/water separator shall be 500 L/s air flow, four 12 mm inlet connections, one 25 mm water outlet, and one 25 mm oil outlet connection. Provide one year supply of maintenance kit.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Plastic pipe shall not be installed in air plenums. Piping located in

shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA-01. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 1.5 m outside the building, unless otherwise indicated. A full port ball valve and drain shall be installed on the water service line inside the building approximately 150 mm above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 300 mm below the finish grade or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 12 mm between finished covering on the different services. Bare and insulated water

lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 100 mm and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Pipe Drains

Pipe drains indicated shall consist of 20 mm hose bibb with renewable seat and full port ball valve ahead of hose bibb. At other low points, 20 mm brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 15 m in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

3.1.1.7 Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 100 mm in diameter or larger shall be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 14 MPa after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.1.8 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on cold-water

supplies and shall be located as generally indicated, with precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to PDI WH 201. Vertical capped pipe columns will not be permitted.

3.1.2 Compressed Air Piping (Non-Oil Free)

Compressed air piping shall be installed as specified for water piping and suitable for 862 kPa working pressure. Compressed air piping shall have supply lines and discharge terminals legibly and permanently marked at both ends with the name of the system and the direction of flow.

3.1.3 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.3.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.3.2 Mechanical Couplings

Grooved mechanical joints shall be prepared according to the coupling manufacturer's instructions. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, or narrow-land micrometer. Groove width and dimension of groove from end of the pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.1.3.3 Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 65 mm and smaller; flanges shall be used on pipe sizes 80 mm and larger.

3.1.3.4 Copper Tube and Pipe

The tube or fittings shall not be annealed when making connections.

- a. Brazed. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.

- b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 50 mm and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015. Soldered joints shall not be used in compressed air piping between the air compressor and the receiver.
- c. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with ICC IPC.

3.1.3.5 Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

3.1.3.6 Other Joint Methods

3.1.4 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.5 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.5.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for supply, drainage, waste and vent pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with

each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 100 mm above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 6 mm clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C 920 and with a primer, backstop material and surface preparation as specified in Section 07900A JOINT SEALING. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed 12 mm from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and concrete wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in Section 07840A FIRESTOPPING.

3.1.5.2 Flashing Requirements

Pipes passing through roof shall be installed through a 4.9 kg per square meter copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 200 mm from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 250 mm. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 200 mm from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 250 mm in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.5.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 40 mm to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 40 mm; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 200 mm from the drainpipe and shall be lapped between

the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 40 mm to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

3.1.5.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

- a. A standard roof coupling for threaded pipe up to 150 mm in diameter.
- b. A tack-welded or banded-metal rain shield around the pipe.

3.1.5.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 6 to 13 mm wide by 6 to 10 mm deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07900A JOINT SEALING.

3.1.6 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07840A FIRESTOPPING.

3.1.7 Supports

3.1.7.1 General

Hangers used to support piping 50 mm and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

3.1.7.2 Pipe Supports and Structural Bracing, Seismic Requirements

Piping and attached valves shall be supported and braced to resist seismic loads as specified in Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 15070A SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT. Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided. Material used for supports shall be as specified in Section 05120 STRUCTURAL STEEL.

3.1.7.3 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.
- d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- g. Type 39 saddles shall be used on insulated pipe 100 mm and larger when the temperature of the medium is 15 degrees C or higher. Type 39 saddles shall be welded to the pipe.
- h. Type 40 shields shall:
 - (1) Be used on insulated pipe less than 100 mm.
 - (2) Be used on insulated pipe 100 mm and larger when the temperature of the medium is 15 degrees C or less.
 - (3) Have a high density insert for all pipe sizes. High density inserts shall have a density of 128 kg per cubic meter or greater.
- i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 300 mm from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 m apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 49 degrees C for PVC and 82 degrees C for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.
- j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 4.5 m nor more than 2 m from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.
- k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint

the following may be used:

- (1) On pipe 100 mm and larger when the temperature of the medium is 15 degrees C or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.
 - (2) On pipe less than 100 mm a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.
 - (3) On pipe 100 mm and larger carrying medium less than 15 degrees C a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.
- l. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.
 - m. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 100 mm or by an amount adequate for the insulation, whichever is greater.
 - n. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

3.1.7.4 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

3.1.8 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.9 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 100 mm will not be required. A cleanout installed in

connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 100 mm. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 450 mm of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be plastic.

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 150 mm above the top of the tank or water heater.

3.2.2 Heat Traps

Piping to and from each water heater and hot water storage tank shall be routed horizontally and downward a minimum of 600 mm before turning in an upward direction.

3.2.3 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.2.4 Expansion Tank

A pre-charged expansion tank shall be installed on the cold water supply between the water heater inlet and the cold water supply shut-off valve. The Contractor shall adjust the expansion tank air pressure, as recommended by the tank manufacturer, to match incoming water pressure.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Marine Type Flushometer Valves

Marine type flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flushometer valves for water closets shall be installed 1 m above the floor, except at water closets intended for use by the physically handicapped where flushometer valves shall be mounted at approximately 760 mm above the floor and arranged to avoid interference with grab bars. In addition, for water closets intended for handicap use, the flush valve handle shall be installed on the wide side of the enclosure.

3.3.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 775 mm above finished floor. Wall-hung drinking fountains and water coolers shall be installed with rim 1020 mm above floor. Wall-hung service sinks shall be mounted with rim 700 mm above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with ICC A117.1.

3.3.4 Shower Bath Outfits

The area around the water supply piping to the mixing valves and behind the escutcheon plate shall be made watertight by caulking or gasketing.

3.3.5 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper

relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

3.3.5.1 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.3.6 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with ICC IPC at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.3.7 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METAL.

3.3.8 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 50 mm above the flood rim of the funnel to provide an acceptable air gap.

3.3.9 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D 3311. Traps for acid-resisting waste shall be of the same material as the pipe.

3.4 VIBRATION-ABSORBING FEATURES

Mechanical equipment, including compressors and pumps, shall be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor

or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed load rating. Piping connected to mechanical equipment shall be provided with flexible connectors. Isolation unit installation shall limit vibration to 20 percent of the lowest equipment rpm.

3.4.1 Tank- or Skid-Mounted Compressors

Floor attachment shall be as recommended by compressor manufacturer. Compressors shall be mounted to resist seismic loads as specified in Section 15070A SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT.

3.4.2 Foundation-Mounted Compressors

Foundation attachment shall be as recommended by the compressor manufacturer. Compressors shall be mounted to resist seismic loads as specified in Section 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT.

3.5 IDENTIFICATION SYSTEMS

3.5.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 35 mm minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.5.2 Pipe Color Code Marking

Color code marking of piping shall be as specified in Section 09900 PAINTS AND COATINGS.

3.5.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 12 mm in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 1 m width, 750 mm height, and 12 mm thickness. The board shall be made of wood fiberboard and framed under glass or 1.6 mm transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 20 mm in diameter and the related lettering in 12 mm high capital letters. The color code board shall be mounted and located in the mechanical or equipment room.

3.6 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.7 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09900 PAINTS AND COATINGS.

3.8 TESTS, FLUSHING AND DISINFECTION

3.8.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with ICC IPC, except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, the Contractor must submit a testing procedure to the Contracting Officer for approval.

- a. Drainage and Vent Systems Test. The final test shall include a smoke test.
- b. Building Sewers Tests.
- c. Water Supply Systems Tests.

3.8.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies. Gauges shall be tested annually for accuracy in accordance with the University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14). Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	
Test Pressure Readings	Serial Number and Test Data of
Gauges	

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.8.1.2 Compressed Air Piping (Nonoil-Free)

Piping systems shall be filled with oil-free dry air or gaseous nitrogen to 1.03 MPa and hold this pressure for 2 hours with no drop in pressure.

3.8.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

3.8.3 System Flushing

3.8.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 1.2 meters per second through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. All faucets and drinking water fountains, to include any device considered as an end point device by NSF 61, Section 9, shall be flushed a minimum of 1 L per 24 hour period, ten times over a 14 day period.

3.8.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation.

3.8.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

- a. Time, date, and duration of test.
- b. Water pressures at the most remote and the highest fixtures.

- c. Operation of each fixture and fixture trim.
- d. Operation of each valve, hydrant, and faucet.
- e. Pump suction and discharge pressures.
- f. Temperature of each domestic hot-water supply.
- g. Operation of each floor and roof drain by flooding with water.
- h. Operation of each vacuum breaker and backflow preventer.
- i. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.
- j. Compressed air readings at each compressor and at each outlet. Each indicating instrument shall be read at 1/2 hour intervals. The report of the test shall be submitted in quadruplicate. The Contractor shall furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary water and electricity.

3.8.5 Disinfection

After operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. System shall be flushed as specified, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Except as herein specified, water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being disinfected shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water. Following a 6 hour period, no less than 50 ppm chlorine residual shall remain in the tank. If after the 24 hour and 6 hour holding periods, the residual solution contains less than 25 ppm and 50 ppm chlorine respectively, flush the piping and tank with potable water, and repeat the above procedures until the required residual chlorine levels are satisfied. The system including the tanks shall then be flushed with clean water until the residual chlorine level is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. Samples of water in disinfected containers shall be obtained from several locations selected by the Contracting Officer. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. Disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at

least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.9 PLUMBING FIXTURE SCHEDULE

P-1 WATER CLOSET:

Siphon-jet, elongated bowl, top supply spud, ASME A112.19.2M, floor mounted. Floor flange shall be copper alloy, cast iron, or plastic.

Gasket shall be wax type.

Seat - ANSI Z124.5, Type A, white plastic, elongated, open front.

Marine Type Flushometer Valve - ASSE 1037, large diaphragm type with non-hold-open feature, backcheck angle control stop, and vacuum breaker. Minimum upper chamber inside diameter of not less than 66.7 mm at the point where the diaphragm is sealed between the upper and lower chambers. The maximum water use shall be 6 liters per flush.

P-2 WATER CLOSET HANDICAPPED:

Height of top rim of bowl shall be in accordance with ICC A117.1; other features are the same as P-1.

P-3 URINAL:

Wall hanging, with integral trap and extended shields, ASME A112.19.2M siphon jet. Top supply connection, back outlet.

Marine Type Flushometer Valve - Similar to Flushometer Valve for P-1. The maximum water use shall be 3.8 liters per flush.

P-4 LAVATORY:

Manufacturer's standard sink depth, 533 by 457 mm, vitreous china ASME A112.19.2M, ledge back.

Faucet - Faucets shall meet the requirements of NSF 61, Section 9. Faucets shall be single center set type. Faucets shall have replaceable seats and washers. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. Flow shall be limited to 1 liter per cycle at a flowing water pressure of 549 kPa if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 0.16 liters per second at a flowing pressure of 549 kPa.

Handles - Lever type. Cast, formed, or drop forged copper alloy.

Drain - Strainer shall be copper alloy or stainless steel. See paragraph FIXTURES for optional plastic accessories.

P-5 WHEELCHAIR LAVATORY:

Vitreous china, ASME A112.19.2M, wheelchair lavatory with wrist or elbow controls 508.0 mm wide x 685.8 mm deep with gooseneck spout. Flow shall be limited to 1 liter per cycle at a flowing water pressure of 549 kPa if a metering device or fitting is used that limits the period of water discharge such as foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 0.16 liters per second at a flowing water pressure of 549 kPa.

Drain - Strainer shall be copper alloy or stainless steel.

P-6 KITCHEN SINK:

Ledge back with holes for faucet and spout single bowl 609.6 x 533.4 mm, stainless steel ASME A112.19.3M.

Faucet and Spout - Faucets shall meet the requirements of NSF 61, Section 9. Cast or wrought copper alloy. Aerator shall have internal threads. Flow shall be limited to 1 liter per cycle at a flowing water pressure of 549 kPa if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 0.16 liters per second at a flowing water pressure of 549 kPa.

Handle - Cast copper alloy, wrought copper alloy, or stainless steel.

Single lever type.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc., shall be copper alloy or stainless steel.

P-7 SERVICE SINK:

Enameled cast iron ASME A112.19.1M, copper alloy or stainless steel ASME A112.19.3M trap standard 609.6 mm wide x 508.0 mm deep (24 inches wide x 20 inches deep), splashback 228.6 mm high.

Faucet and Spout - Cast or wrought copper alloy, with top or bottom brace, with backflow preventer. Faucets shall have replaceable seat and the washer shall rotate onto the seat. Handles shall be lever type. Strainers shall have internal threads.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc., shall be copper alloy or stainless steel.

Trap - Cast iron, minimum 7.5 cm diameter.

P-8 SHOWER:

Shower heads, CID A-A-240 other than emergency showers, shall be adjustable spray type and shall include a non-removable, tamperproof device to limit water flow to 0.16 liters per second when tested in accordance with ASME A112.18.1.

Wall Mounted: Shower head shall be adjustable spray, stainless steel or chromium plated brass with ball joint. Handles shall be chrome-plated die cast zinc alloy. Control valves shall be copper alloy and have metal integral parts of copper alloy, nickel alloy, or stainless steel. Valves shall be pressure balancing type. Shower head shall be vandalproof with integral back.

Emergency Eye Wash/Shower: Head for Emergency and Emergency Eye and Face Wash. Shower control shall be 32 mm stay-open type control valve. Unit shall be corrosion-resisting steel and shall be pedestal mounted. Emergency showers shall comply with ANSI Z358.1. Fountain, ANSI Z358.1, eye wash, self-cleaning, non-clogging eye and face wash with quick opening, full-flow valves, corrosion-resisting steel eye and face wash receptor. Unit shall deliver 0.19 L/s of aerated water at 207 kPa flow pressure, with eye and face wash nozzles 838 to 1143 mm above finished floor. Copper alloy control valves shall be provided. An air-gap shall be provided with the lowest potable eye and face wash water outlet located above the overflow rim by not less than the ICC IPC minimum per IPC Table 608.15.1.

P-9 WATER COOLER DRINKING FOUNTAINS:

Drinking fountains shall meet the requirements of NSF 61, Section 9. Water cooler drinking fountains shall: be self contained, conform to ARI 1010, use one of the fluorocarbon gases conforming to ARI 700 and ASHRAE 34 which has an Ozone Depletion Potential of less than or equal to 0.05, have a capacity to deliver 30.2 liters per hour of water at 10 degrees C with an inlet water temperature of 27 degrees C while residing in a room environment of 32 degrees C, and have self-closing valves. Self-closing valves shall have automatic stream regulators, have a flow control capability, have a push button actuation or have a cross-shaped index metal turn handle without a hood. Exposed surfaces of stainless steel shall have

No. 4 general polish finish. Spouts shall provide a flow of water at least 100 mm high so as to allow the insertion of a cup or glass under the flow of water.

Surface Wall-Mounted - Surface wall-mounted units shall be 336.6 mm wide, 330.2 mm deep, and have a back height of 152.4 to 203.2 mm, as approved, based on availability. The bowl shall be made of stainless steel. The unit shall have concealed fasteners and be for interior installation.

Handicapped - Handicapped units shall be surface wall-mounted. The dimensions shall be 381.0 mm wide, 508.0 mm deep, with a back height of 152.4 to 203.2 mm. The unit shall clear the floor or ground by at least 200 mm. A clear knee space shall exist between the bottom of the bowl and the floor or ground of at least 685 mm and between the front edge of the bowl and the body of the unit of at least 200 mm. A 200 mm wide clear space shall exist on both sides of the unit. The spout height shall be no more than 1 m above the floor or ground to the outlet. The spout shall be at the front of the unit and direct the water flow in a trajectory that is parallel or nearly parallel to the front of the unit. The bowl shall be 165.1 mm high, made of stainless steel and be for interior installation.

3.10 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.11 PERFORMANCE OF WATER HEATING EQUIPMENT

Standard rating condition terms are as follows:

EF = Energy factor, overall efficiency.

SL = Standby loss in W/0.093 sq. m. based on 27 degrees C delta T, or in percent per hour based on nominal 38 degrees C delta T.

V = Storage volume in liters

3.11.1 Storage Water Heaters

3.11.1.1 Electric

- a. Storage capacity of 454 liters or less, and input rating of 12 kW or less: minimum energy factor (EF) shall be 0.95-0.00132V per 10 CFR 430.
- b. Storage capacity of more than 454 liters or input rating more than 12 kW: maximum SL shall be 1.9 w/0.093 sq. m. per ASHRAE 90.1, Addenda B.

3.12 TABLES

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE				
		A	B	C	D	E
1	Wrought copper grooved joint pressure pressure fittings for non-ferrous pipe ASTM B 75M, C12200, ASTM B 152/B 152M, C11000, ASME B16.22	X	X			
2	Cast copper alloy solder joint pressure fittings, ASME B16.18 for use with Item 3				X	X
3	Seamless copper pipe, ASTM B 42		X			
4	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X
5	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D 2665, ASTM F 891, (Sch 40) ASTM F 1760	X	X	X	X	X

SERVICE:

- A - Underground Building Soil, Waste and Storm Drain
- B - Aboveground Soil, Waste, Drain In Buildings
- C - Underground Vent
- D - Aboveground Vent
- E - Interior Rainwater Conductors Aboveground

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item No.	Pipe and Fitting Materials	SERVICE			
		A	B	C	D
1	Seamless copper pipe, ASTM B 42	X	X		X
2	Seamless copper water tube, ASTM B 88M	X**	X**	X**	X***
3	Cast bronze threaded fittings, ASME B16.15 for use with Item 1	X	X		X
4	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Item 1	X	X	X	X
5	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Items 2 and 3	X	X	X	X
6	Chlorinated polyvinyl chloride (CPVC) plastic hot and cold water distribution system, ASTM D 2846/D 2846M	X	X		X
7	Chlorinated polyvinyl chloride (CPVC) plastic pipe, Schedule 40 and 80, ASTM F 441/F 441M	X	X		X
8	Chlorinated polyvinyl chloride (CPVC) plastic pipe (SDR-PR) ASTM F 442/F 442M	X	X		X
9	Threaded chlorinated polyvinyl chloride (chloride CPVC) plastic pipe fittings, Schedule 80, ASTM F 437, for use with Items 7 and 8	X	X		X
10	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 40, ASTM F 438 for use with Items 7, 8, and 9	X	X		X
11	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings Schedule 80, ASTM F 439 for use with Items 7, 8, and 9	X	X		X
12	Polyvinyl chloride (PVC) plastic pipe, Schedules 40, 80, and 120, ASTM D 1785	X			X
13	Polyvinyl chloride (PVC) pressure-rated pipe (SDR Series), ASTM D 2241	X			X

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item No.	Pipe and Fitting Materials	SERVICE			
		A	B	C	D
14	Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D 2466	X			X
15	Socket-type polyvinyl chloride (PVC) plastic pipe fittings, Schedule 80, ASTM D 2467 for use with Items 13 and 14	X			X
16	Threaded polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D 2464	X			X
17	Joints for IPS pvs pipe using solvent cement, ASTM D 2672	X			X

A - Cold Water Aboveground

B - Hot Water 82 degree C Maximum Aboveground

C - Compressed Air Lubricated

D - Cold Water Service Belowground

Indicated types are minimum wall thicknesses.

** - Type L - Hard

*** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors

TABLE III
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING
EQUIPMENT

A. STORAGE WATER HEATERS

FUEL	STORAGE CAPACITY LITERS	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE
Elect.	454 max.	12 kW max.	10 CFR 430	EF = 0.95-0.00132V minimum
Elect.	454 min. OR	12 kW min.	ASHRAE 90.1 (Addenda B)	SL = 1.9 W/0.09 sq. m. maximum

TERMS:

EF = Energy factor, overall efficiency.
SL = Standby loss in W/0.09 sq. m. based on 27 degrees C delta T, or in
percent per hour based on nominal 32 degrees C delta T.
V = Storage volume in gallons

-- End of Section --